ARCHIVES OF

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Code of Advertising

The *Archives of Physical Medicine and Rehabilitation*, published monthly by the American Congress of Physical Medicine and Rehabilitation, is interested in the maintenance of the highest standards in advertising in the interest of its readers in the medical and closely allied professions, the various manufacturers and patients. The *Archives of Physical Medicine and Rehabilitation* believes that honest, straightforward and informative promotion is essential in the merchandising of products and apparatus affecting the health and welfare of the general public. For this reason, the APM&R has formulated some basic principles to serve as a guide to manufacturers and advertisers.

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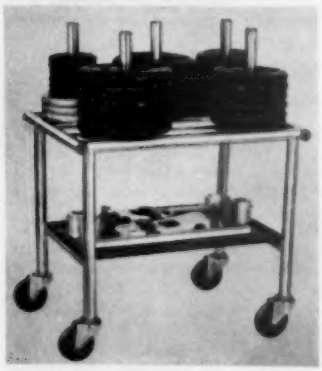

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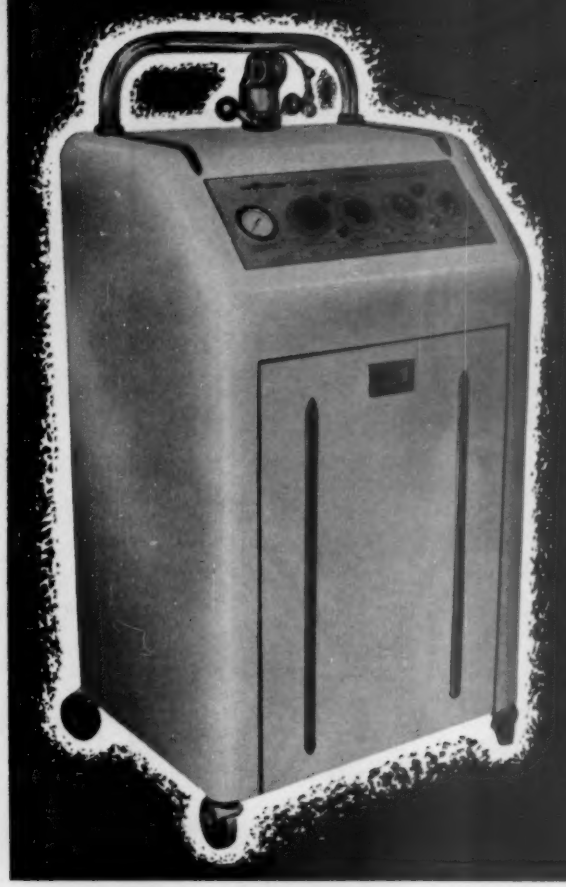

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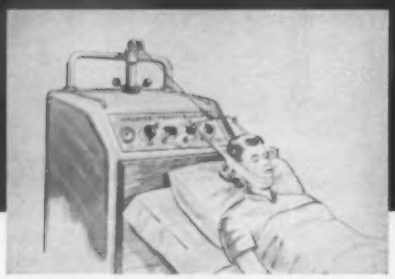

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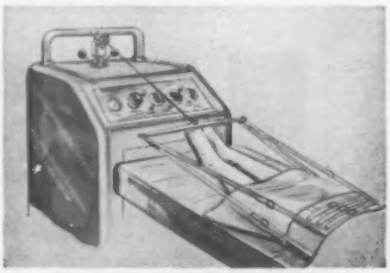

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Executive Director

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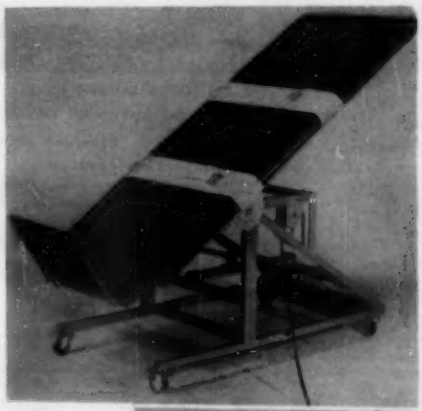

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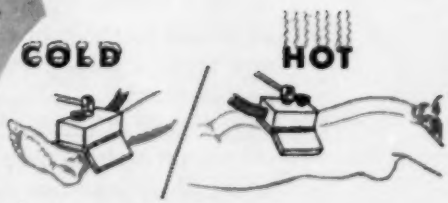

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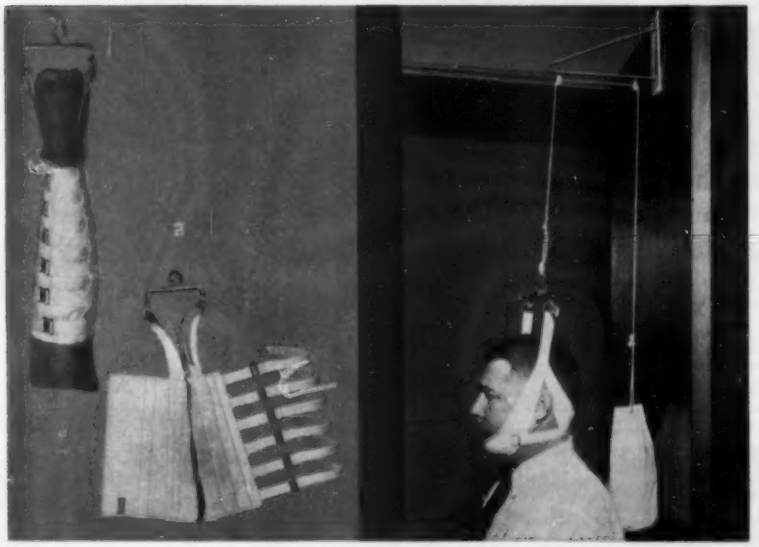

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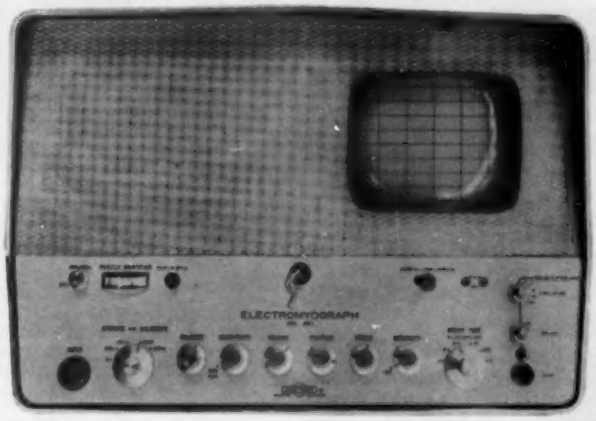

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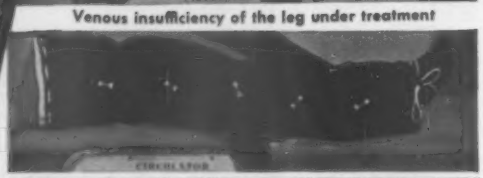

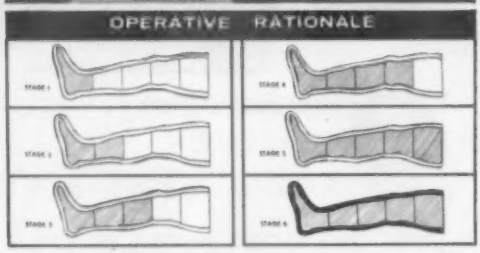

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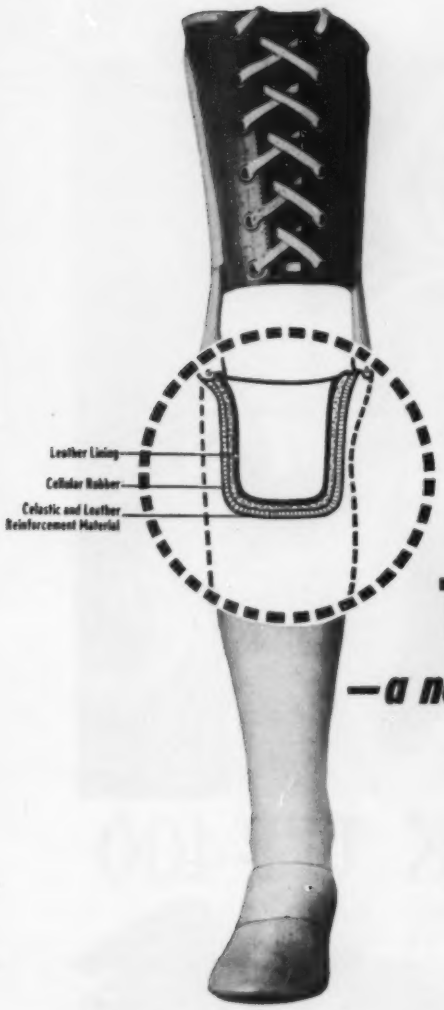

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Use and Abuse of Certain Tools of Physical Medicine

Robert L. Bennett, M.D.
Warm Springs, Ga.

● The author presents an outline of the use and abuse of certain agents commonly used in the field of physical medicine. Each of these tools is essential in the most adequate care of most neuromuscular and musculoskeletal diseases. If misused, each is capable of limiting recovery and causing severe handicap. These tools include mobilization (used synonymously with "stretching") and its abuse, muscle re-education (therapeutic exercise) and its abuse, functional training and its abuse, and orthetic devices and their abuse. In no way decrying their use by emphasizing their abuse, the author indicates there is more truth than poetry in the saying "the brighter the light, the darker the shadow."

When I was asked to prepare a paper on this subject, I was immediately intrigued with the idea of discussing the dangers of physical medicine, particularly the dangers of those measures and devices so commonly used in the everyday practice of medicine and so rarely thought of as being dangerous. I soon realized that I could not possibly cover all the measures and devices of physical medicine in one hour, and I further realized that a sensible discussion of dangers requires some mention of values. Therefore, I am limiting this discussion to the use and abuse of mobilization, muscle re-education, functional training, and orthetic devices. Each is a basic tool of physical medicine used to prevent and overcome physical disability. If misused, each is capable of limiting recovery and causing severe handicap.

This paper was presented at a seminar sponsored by the
American Rehabilitation Foundation

Mobilization

Mobilization is a term commonly used in the prescription of physical medicine to designate the use of physical forces to regain normal length and mobility of tight and contracted bodily tissues. When used in this manner, mobilization is synonymous with "stretching." Mobilization is referred to as being "passive" when the patient voluntarily neither assists nor resists the stretching of the tight or contracted tissue. This is most frequently done by manual pressure, but also can be accomplished by plaster casts or specific orthetic devices. It is termed "active assistive" when the patient attempts to augment the stretching procedures through his own voluntary efforts. It is called "active" when the patient through his own muscular work attempts to stretch his own tissues.

Those tissues that most commonly require stretching in the care of neuromuscular-musculoskeletal diseases are:

1. *Periarticular tissues.* These are the tissues that make up the capsule about a joint, the ligaments that support the joint, and the ligamentous insertions of muscles about the joint. All of these tissues are so intimately intertwined that they are difficult to differentiate.

The direction of forces applied in stretching joints will depend on the type of joint that we are attempting to mobilize. Contractures about the knee, the metacarpophalangeal joints of the hand, or the interphalangeal joints of the fingers are most easily visualized. These joints are excellent examples of hinge joints which require not only the forces necessary to obtain direct flexion or extension but also forces to prevent and overcome subluxation as the joints are flexed or extended.

The articulations between the vertebrae of the spine are far more complex and must be stretched in a line with

Executive Director, Georgia Warm Springs Foundation, Warm Springs, Ga.

Read at the Regional Seminar sponsored by the American Rehabilitation Foundation, State University of New York, School of Medicine, Downstate Medical Center, Brooklyn, New York, April 15-16, 1960.

those tissues most likely to be contracted. In the spine above the lumbosacral region these are the tissues, both ligamentous and muscular, that exist in the region between the transverse processes and the posterior processes of the spine. Therefore, mobilization of the spine should not be in a direct lateral plane, but should be in a diagonal or anterolateral plane so that those tissues in the region between the transverse processes and the posterior processes are adequately stretched. Pure lateral stretching of the spine is completely ineffective in stretching those tissues most likely to be contracted. Actually, lateral stretching of the spine would accelerate rotation and result in greater deformity.

2. *Fascial tissues.* The most common examples of fascial tissues that require stretching are found in the iliotibial fascia of the hip and thigh, and the plantar fascia of the foot. A thorough understanding of the anatomy of these bands is required before adequate stretch can be applied to these tissues. To most adequately stretch the iliotibial fascia, the pelvis has to be firmly stabilized and the knee flexed to at least a right angle. With the pelvis stabilized and the knee flexed, the femur is then internally rotated and the thigh stretched in a position of adduction and extension. Unless the knee is flexed and internally rotated, the full length of the iliotibial band cannot be stretched adequately.

In stretching the plantar fascia, it is extremely important to stabilize the os calcis as the forefoot is brought into a position of abduction and supination. Pressure must be placed against the distal ends of the metacarpals and not against the toes themselves if stretching pressures are to be directed against the plantar fascia.

3. *Musculotendinous tissues.* Contractures of these tissues are most commonly seen in the triceps surae muscle and its tendon achilles, and in the infrapatellar ligament. In stretching the triceps surae and its tendon, the knee must be extended and the os calcis forced into a position of ankle flexion. Pressure against the foot itself in mobilizing the triceps surae and its tendon may result in hypermobility of the mid-foot without any real lengthening being obtained in the triceps surae and its tendon.

Contracture of the infrapatellar ligament is almost impossible to stretch by conservative means. To stretch this tendon adequately would require pressure upward against the patella while the knee is being flexed. Simple flexion of the knee would stretch out the rectus femoris and the other musculature of the quadriceps without being of any real value in stretching the infrapatellar tendon.

4. *Interosseous tissue.* An extremely disabling contracture frequently exists in the interosseous membrane between the radius and the ulna in the forearm. This will result in either a contracture of the forearm in pronation or in supination, the supination contracture being by far the more deforming in terms of functional capacity. Once a true interosseous membrane contracture of the forearm has occurred, very little can be accomplished by conservative stretching. The attempt should be made to mobilize the distal end of the forearm with the elbow in flexion. Any attempt to mobilize the forearm by pressure against the hand simply results in marked hypermobility of the wrist and the metacarpals and has very little effect on movement in the forearm.

Contractures of the skin itself are frequently seen in scleroderma. The skin is most easily stretched by active contraction of the muscles activating the bodily segments underlying the tightened skin. Massage, which has been used extensively in stretching sclerodermatous skin, is more likely to cause increased contracture than increased resiliency and therefore should be avoided.

Muscular masses may be the site of contracture as in polymyositis and are best stretched by active contraction of antagonistic muscular masses. At times it is necessary to add assistive forces to stretch these masses when the underlying muscles are markedly weakened.

It might be wise to emphasize at this point that the extent of structural change will determine the effectiveness of mobilization of the tissues mentioned previously. There is no way by conservative methods of altering the contour of skeletal struc-

tures as, for example, compression of the bodies of the vertebrae by stretching methods. The regaining of mobility, however, will minimize the danger of further skeletal abnormalities.

Abuse

The dangers of stretching the tissues have been implied in the discussion of the stretching technics essential to mobilization of these tissues. Irresponsible stretching has four major dangers:

1. *Trauma.* Violent or excessive stretching of these tissues will cause pain and protective muscle spasm resulting in further deformity. More violent stretching may actually cause tearing of soft tissue with resultant scarring, or even fracture of underlying bony structures. Adequate stretching of the iliotibial fascia, for example, must accept the risk of fracturing the femur in patients with severe muscular weakness and skeletal demineralization. It takes a great deal of experience to know how much pressure can be placed against the long bones when mobilization of adjacent joints is necessary. While violent and damaging stretching is to be avoided at all costs, it must be remembered that unless stretching has adequate force behind it the results that are hoped for will never be realized.

2. *Hypermobility or undesirable mobility.* It should be a basic rule of mobilization that no bodily region should be mobilized unless the underlying strength of the musculature supporting that bodily segment is known. Mobility without underlying strength to support mobility may be far more dangerous than loss of mobility.

The most dramatic example of this exists in the spinal column. Unless the musculature supporting the alinement of the spine is under good and balanced voluntary control, restoration of mobility might permit the development of severe scoliosis. A rigid straight spine is always preferable to a mobile crooked one.

Perhaps the greatest danger of mobilization lies in the development of asymmetrical mobility. In mobilizing any bodily segment, there should be the constant attempt to regain an equal amount of mobility in all of the functional planes of that segment. This, again, is most dramatic in the spine where haphazard mobility is very likely to result in asymmetrical mobility and actually cause or augment the development of lateral or anterolateral deviations. Mobility in itself has no value unless there is underlying musculature to utilize safely the mobility that is obtained. The utilization may be through voluntary muscular activity, or may be through the use of orthetic devices that increase functional capacity even though voluntary strength is not present. The basic rule governing mobilization must always be a knowledge of underlying strength to support mobile bodily segments, or the ability to apply devices that will safely maintain the proper skeletal alinement and prevent deformity. Unless this is possible, tightness may be far less dangerous than mobility.

3. *Mobilization of adjacent bodily segments.* Unless mobility is carried out intelligently, we constantly run the risk of mobilizing regions of the body below or above those regions that need specific mobilization. The dangers of this abuse of stretching is frequently seen during the attempts to mobilize the iliotibial fascia. Unless the pelvis is adequately supported, the act of stretching the iliotibial fascia may result not in lengthening this band but rather in further deviating the lumbar spine above the pelvis. Attempts to stretch the plantar fascia of the foot frequently result only in stretching out the triceps surae and its tendon achilles and result not in release of the cavus deformity of the foot but rather in the development of further calcaneocavus.

4. *Altered musculotendinous relationships.* Attempts to stretch muscle tendons, whether by manual methods, plaster wedging, or even surgical tendon lengthening, very commonly result in altered length of the tendon as related to the length of the muscle mass. This is frequently seen in stretching the triceps surae and its tendon achilles. As the tendon achilles is lengthened, the muscle mass of the gastrocnemius and soleus muscles shortens and loses its efficiency. It is not uncommon to find that as the tendon achilles is stretched out, the

strength of the triceps surae decreases. If the tendon alone is lengthened, the muscle itself shortens and loses marked strength. I know of no way to specifically stretch the muscle mass, if it is contracted, and thus avoid the danger of stretching the muscle's tendon. The only point of emphasis is that we must remember that if muscles are to be stretched, they must be gently mobilized very early in the development of their contracture.

Muscle Re-Education (Therapeutic Exercise)

Muscle re-education is an important, perhaps the most important tool in physical medicine. By the various technics of muscle re-education, we are able to initiate voluntary control of skeletal muscle, to strengthen the voluntary contraction of muscle, to coordinate its use, and to develop endurance in those bodily activities requiring muscular action.

Traditionally, muscle re-education is usually initiated by attempts to passively move bodily segments, to initiate proprioceptive reflex responses, and to keep the individual aware of bodily movement. Such passive movements which are done without assistance or resistance on the part of the patient can be carried out through manual movements or by mechanical devices. They may be electrically induced, or they may be induced by the stimulation of normal or pathologic reflex activity. Passive motion of this type is essential to the care of all neuromuscular diseases that result in severe loss of voluntary muscle contraction. Such passive movement obviously maintains or assists in regaining mobility of bodily segments, assists in the mobilization of tissue fluids, and in return of venous blood proximally. In addition, it maintains the patient's awareness of movement and initiates proprioceptive receptor response.

As voluntary response is obtained, muscle re-education becomes active assistive in nature. This means that the patient attempts to move bodily segments assisted by the physician or therapist. This is an extremely difficult phase of muscle re-education in that the assistance must be carefully applied so as not to take over all of the power necessary for the movement and thus limit the patient's contribution (feeling of contraction and proprioceptive stimulation), nor be so minimal as to expect the patient to move segments against forces that cannot be overcome by his voluntary strength. If the segment is moved too rapidly, the patient loses his ability to take part in the movement and if the movement is too slow, the patient is incapable of maintaining a sustained contraction necessary for recovery of strength and coordination.

As the patient develops sufficient strength and coordination to support activity, the muscle re-education program then becomes one of active exercise. The patient without assistance from the physician or therapist carries out movements to increase strength, coordination, and endurance.

Examples of activation technics are common in traditional muscle re-education. All attempts to have the patient sit in an upright position, or stand, or even carry out moving activities such as walking or step climbing, tend to initiate proprioceptive reflexes that reflexly contract muscles to aid in stabilization as well as movement of bodily segments. Both posture and movement will stimulate these proprioceptive reflexes. Proprioceptive facilitation may be obtained by resistance to segmental movement, or by specific initiation of normal and pathologic reflexes. A typical example of these technics would be tapping of the extensor muscles in the forearm to facilitate wrist and finger extension. A more involved example of these technics would be the use of resisted mass movements to facilitate specific reflex response. It must be emphasized that these technics have value only in the attempt to properly focus impulses to muscles not under voluntary control and to assist in the recovery of voluntary control by more accurate focusing of the patient's own voluntary attempts. The use of appropriate electrical currents to bring about contraction of skeletal muscle not under the voluntary control of the patient is an accepted phase of muscle re-education. Such stimulation can be used not only to assist in maintaining the circulation and resiliency of contractile tissue, but also

to act as a valuable focusing mechanism to initiate proprioceptive responses and to keep the patient aware of muscular contraction. The electromyograph also can be utilized to assist the patient in more properly focusing his voluntary attempts through seeing or hearing the changes in electrical potential as minimal voluntary contraction takes place. This is particularly useful in the re-education of muscles with transplanted tendons in order to bring about movements not controlled by these muscles when their tendons are in their normal position.

Examples of active assistive muscle re-education are common and, as stated above, may be accomplished by manual assistance on the part of the physician or therapist, or through the use of certain mechanical devices. The overhead sling attached to a wheelchair to provide functional use of the upper extremity is well known. With this device the flail shoulder girdle may receive proprioceptive reflex stimulation and the weakened shoulder girdle and arm may receive assistance to accomplish functional ranges of motion. The elastic components of such an overhead sling provides the positioning and oscillation essential to proprioceptive stimulation and assists functional use. The hand splint with elastic assistive attachments is also an excellent example of providing active assistive exercise by means of orthetic devices.

The use of active exercise hardly needs further explanation. The resistance required for increasing strength, coordination, and endurance may be applied with the weight of the bodily segments themselves, or through the addition to these segments of properly placed weights. The demands placed against active bodily movement are increased consistent with the ability of the patient to maintain coordinate patterns of movement when carrying out the exercises prescribed.

Abuse

Since muscular work is necessary to regain muscular strength, there is the tendency to believe that any type of activity constitutes exercise of therapeutic value. Great care must be taken to explain to the patient the difference between specifically prescribed muscle re-education and activity that is required of him in moving about and doing the things that he wants to do or has to do. There are four major dangers in any program of exercise. The dangers are greatest during periods of haphazard and unsupervised activity, but may actually be present even in the best regulated program of muscle re-education.

1. *Development of abnormal patterns of movement.* The primary purpose of all muscle re-education programs is to restore to the patient normal and acceptable patterns of movement. This demands, during the time that recovery is possible, strict avoidance of any patterns of movement that might compromise recovery of normal patterns. Substitution movements are simply voluntary attempts to carry on activity, utilizing whatever voluntary control is obtainable and ignoring those muscles that are too weak to take part in activity. The most common pattern of substitution seen is the attempt to forward flex the arm when the deltoid muscle is paralyzed by elevating the shoulder and thrusting it forward. Another common substitution pattern is adduction and extension of the thumb in the presence of weakness of the intrinsic muscles of the thumb in order to oppose the thumb to the index and long fingers.

Various patterns of abnormal gait, usually referred to as "limping," are examples of substitute patterns of movement to accomplish desired activities. If substitute patterns of motion are permitted during the recovery phase, they may become so deeply grooved that when recovery does take place the recovered muscle will not be utilized properly and the faulty patterns may be difficult if not impossible to correct. Any pattern of substitution also puts abnormal stress against supporting as well as contractile tissue and may, through this abnormal stress, cause deformity as well as limitation of recovery. There should be no confusion between the terms "substitution" and "incoordination." Substitution is a voluntary attempt, although some of its components are at a subconscious

level, to accomplish a desired activity by abnormal movements of bodily segments. Coordination may be defined simply as the ability to use the right muscles at the right time and with the proper intensity to most efficiently achieve a desired movement. The mechanics of coordination are highly complex, with most of its components at a subconscious level entirely beyond the voluntary control of the patient. It should be understood that all initial muscle re-education should be based on the assumption that strength and balance, sufficient for necessary activity, eventually will be regained. It is essential therefore to immediately recognize and alter any substitution patterns, because such a pattern can become deeply ingrained as a condition response and so limit the best use of muscles that might later regain strength.

2. *Development of, or increase in, muscle imbalance.* By far the most important danger of therapeutic exercise lies in the development of muscle imbalance through haphazard and irresponsible attempts to strengthen bodily segments. A classic example is the further development of a flexor synergy in the forearm and hand of a hemiplegic following a cerebral vascular accident, by encouraging the patient to squeeze a ball in the palm of the hand by flexion of the fingers and thumb. Other examples are seen in the shoulder girdles and the trunk of patients with lower motor unit involvement. In the shoulder girdle, when severe weakness is present but recovery is possible, great care must be taken not to over-develop the deltoid at the expense of the serratus, or conversely, the serratus at the expense of the deltoid. Most frequently, the deltoid is given the better protection and the more conscientious exercise. These attempts to strengthen the deltoid put serious strain against the weakened serratus. As the deltoid recovers in strength, it contracts strongly, depressing and adducting the scapula and throwing all of the weight of the upper extremity against a weakened serratus. This causes marked winging of the scapula, stretching of the serratus, and either limitation of recovery or actual loss of strength in the serratus. Likewise, attempts to move the shoulder, activating the serratus strongly, may elevate the acromium, putting the deltoid at a disadvantage, and causing a limitation of its recovery. At some point the imbalance becomes so great that no type of protection is capable of salvaging the weakened group.

The very dangerous dynamic pelvic obliquity, causing a severe lumbar scoliosis, is an excellent example of muscle imbalance that could have been avoided or minimized with proper early recognition. When unilateral weakness exists in the abdominal wall, and in the quadratus lumborum, any attempts to stabilize or move the trunk result in greater imbalance of strength. Unless this is recognized early, and the stronger muscles put at a disadvantage and the weaker muscles specifically exercised, the imbalance will result eventually in the adaptive shortening of the stronger muscles and a structural scoliosis.

Adequate muscle re-education demands not only the ability to determine muscle weakness and to institute specific exercises to overcome this weakness, but also the ability to intelligently neglect those muscles that are stronger than their opposing groups until such time that the opposing groups can safely counteract and balance the pull of the stronger groups. Haphazard, unsupervised muscle re-education invariably leads to the development of further muscle imbalance, limitation of functional capacity and structural deformity.

3. *Overwork.* While it is true that muscle strength depends on muscle work, it is not true that added work will always result in added strength. In other words, it is not always true that if a little exercise is good, more exercise must be better. It is quite possible, under certain circumstances, to limit recovery of strength and actually cause a decrement of strength through overwork of muscle. This may occur during haphazard activity, or even during periods of specific muscle re-education. This abuse of exercise is so little appreciated that it requires somewhat greater elaboration than do the other dangers. First, we must be sure that we do not confuse the terms "fatigue" and "overwork." They are in no way synonymous. Fatigue is a per-

fectly normal and physiologic reaction that protects the normal individual from overwork. Because the symptoms of fatigue are disagreeable and most of us are inherently lazy, the average person has a muscular system in a state of disuse and in no great danger of overwork weakness. Why, then, must we even consider the danger of overwork? It can be stated unequivocally that many of us who have had the opportunity of observing patients who are under a program of muscle re-education occasionally have seen these patients show a progressive, long-lasting and occasionally even irreversible deterioration of muscle strength, rather than the expected increase in strength.

If we first rule out the more common causes of decrease in strength, such as disuse, the pathologic changes that follow complete denervation in muscular tissue, contracture or unusual stretching of muscle, or changes in relationship of tendon length to muscle mass, we are still faced with individuals who temporarily or permanently lose strength following specific bouts of exercise. Overwork can be recognized by an unusually long rest period required for recovery after a bout of exercise or activity. It is, of course, a well known fact that perfectly normal muscle can be worked to a point where it is unable to contract again until after a period of rest. This normal and physiologic reaction is certainly due in great part to the accumulation of waste products which in turn is related to the available blood supply and tissue drainage. It is also directly related to the motivation on the part of the individual undergoing exercise. As stated previously, the normal individual is protected by the disagreeable sensation of tiredness, and is not likely to repeat the exercise until these symptoms subside. Patients with spotty involvement of lower motor units may not be so fortunately protected. Certainly they are highly motivated, because they realize that recovery of muscle strength is the key to their increased functional capacity, and that muscular strength is recovered by exercise. It is also entirely possible that they do not sense the disagreeable feeling of fatigue, occasioned by an overworked circulation, simply because their available blood supply may be greater than normal on the basis that, while their circulation is relatively unchanged, their numbers of contracting motor units are much less. They may, therefore, repeatedly overwork certain muscles and thus extend the period of rest required for recovery to impractical length, and finally to irreversible functional loss. It would seem apparent that the frequent clinical observation of loss of muscle strength during periods of functional activity, or even during programs of specific muscle re-education in patients with specific neuromuscular or musculoskeletal disease may be on the basis of some combination of motivation, changes in the dynamic circulation, and failure to perceive normal sensations of fatigue. This simply means that the physician or therapist should not rely on the disagreeable sensations of fatigue to guard patients against the dangers of overwork. We must depend entirely on our abilities to detect very minor changes in the patterns of movement that would indicate loss of strength in certain components of the movement pattern. Certainly in dealing with weight-bearing muscles, or muscles that are used repeatedly in recreational or vocational pursuits, repeated spot checks of these muscles by the routine manual muscle test are necessary to bring out the gradual loss of strength from overwork. Under close observation, loss of strength due to overwork can be recognized early and cared for before it becomes irreversible. Weakness following overwork develops not only during periods of recovery, but may occur years after the patient has discontinued his specific program of supervision by his physician or therapist. It must be thoroughly appreciated that we should not be worried about the very temporary loss of muscle power following a bout of exercise. This is normal, and may well be followed after a rest period by increased strength. Rather, we must be concerned that persistent overwork of the muscle may eventually lead to irreversible weakness, not discovered early and counteracted by adequate rest.

4. *Over-stress of skeletal structures.* Any program of exercise designed to increase the strength of a particular

bodily segment may put unusual and damaging stress against adjacent segments. It is not unusual to find patients with weakness in the trunk and an incipient scoliosis attempting to develop great strength in arms and shoulders by a system of lifting increasingly heavy weights. It takes little imagination to visualize what happens to the alinement of the spine under these conditions. Skeletal malalinement from compressing or shearing forces can take place or may occur in any portion of the skeletal system incapable of supporting itself against the abnormal stresses of unusual activity or heavy exercise of adjacent segments or even segments far removed.

Functional Training

Functional training is based on a prescription which in turn is based on the results obtained by specific functional testing. A functional test is simply a measurement of ability of the patient to carry out certain practical and necessary activities. The activities tested will depend on the patient's age and on the specific requirements of the individual's educational or occupational demands when he returns home. A truly effective program of functional training attempts to anticipate all of the demands that will be made on the handicapped individual and to simulate these demands in the functional testing and eventual functional training. For this reason, most rehabilitation centers have the facilities to reduplicate not only the problems of home and school but also of specific occupational endeavors. Specific vocational analysis is carried out not only to determine if the patient is physically capable of carrying out the requirements of a particular job, but also to determine if the patient has a real interest in the type of job situation that psychologic evaluation and vocational counseling would appear most feasible. This, of course, is most important in dealing with the handicapped who either have had no experience in any type of job, or who must change jobs because of their residual disability. If they are previously trained, vocational analysis simply proves to both patient and his physician that he can or cannot continue with the same type of occupation.

Functional capacity is the obvious goal of therapeutic exercise. If all patients recovered normal strength, coordination, and endurance of weakened muscles there would be no great danger in resumption of normal activity. However, many patients are left with varying degrees of muscle weakness that require modifications of normal abilities and require specific training in those functions that are necessary for the activities of daily living or for vocational or recreational pursuits. Functional training is certainly the most interesting phase of physical medicine, and the opportunity to assist the patient to begin doing all of the things that he wants to do at home and at work or school might be considered the reward for all of the tedious hours spent in mobilization and specific muscle re-education.

Abuse

The very fact that the technics of functional training are exciting to both the patient and the physician or therapist who is helping him, constitutes the major danger of functional training. Too frequently the second of dual objectives of functional training is overlooked. The first and obvious objective is to develop practical bodily movements, and endurance in performance of these movements so that the patient can, insofar as is possible, do everything that is required of him when he returns home — everything that is required of him in a normal environment, in contact and competition with normal individuals. The second objective is the one so frequently ignored or poorly understood. This objective is to teach the patient to do all of these things safely. I am not referring to the danger of trauma as from falling or coming in contact with dangerous machinery. Most of us are well aware of these dangers and take them into consideration in the type of functional training that we give; however, not all of us realize that all of the dangers inherent in muscle re-education or therapeutic exercise are markedly magnified when the patient begins functional activity. These are the dangers of

substitution, imbalance, overwork, and overstress. There is no need to review these dangers so we can simply discuss a few examples. I have under my care at the moment two young patients with severe scoliosis markedly aggravated by irresponsible functional training. They are both nine years of age, both received their early convalescent care at Warm Springs several years ago. One was quite severely involved with a quadriplegic distribution of weakness. Because of the critical condition of his spine, he was fitted with a corrected corset and we got him up walking with bilateral long leg braces and Everett-type crutches, in addition to the corset. Even though his upper extremities had recovered reasonably well, his functional training program was limited to operation in the sitting position with restricted periods of standing and walking. We made no attempt to teach him to climb steps nor to even carry out such activities as dressing and undressing. Function was limited at this point because we envisioned the danger of greater function causing rapid deterioration of the alinement of the spine. We spent considerable time discussing this with his family and felt that they understood that while he was capable of carrying out much greater activity, it was simply not safe for him to do so at this time and that the activity would be added as he got older and the structural alinement of his spine permitted. The parents apparently understood this at the time we discussed it with them, but upon returning home were persuaded to admit their child to another institution for emphasis on functional training and apparently were quite delighted at the marked increase in functional capacity that resulted very quickly. Because the corrected corset which included head traction attachment interfered with function, this was removed and worn only haphazardly during periods of rest. They did not return for re-examination at Warm Springs as scheduled and we did not see them again for over a year, at which time the family recognized that a scoliosis had developed that was quite severe and they requested re-examination. When we saw the youngster again the scoliosis was far advanced and failed to respond even with plaster wedging of the spine and re-application of tractive devices. The second patient was similar in that his activity was limited because of an incipient pelvic obliquity due to mild abdominal asymmetry. To minimize the danger of further muscle imbalance, his long leg braces were joined with crossbars and he was taught to walk with a swing-through gait because we had found that a four-point gait simply exaggerated the muscle imbalance at the trunk level. Upon his return home, he came under the care of a therapist who spent all of her time when treating this youngster emphasizing methods of climbing steps because it was felt that he would have to climb steps if he was to return to school. He was taught to climb steps after the bars were removed from the braces by hiking the strong side and then dragging the weaker side up after him. This, of course, markedly emphasized the use of the stronger side so that muscle imbalance became very great and a pelvic obliquity developed quite rapidly. This patient returned after only three months absence and is now being wedged in plaster and is scheduled for fascial reinforcement of the abdominal wall in an attempt to counteract the marked muscle imbalance that developed. While these two cases can be conveniently blamed on someone else, similar problems have arisen in our own patients under what we felt was adequate supervision. Fortunately, most of these cases were picked up a little sooner and didn't present quite as difficult a problem of correction. However, in many instances we have frankly underestimated the stress of activity, even in patients that we have felt were completely out of danger. Too frequently deformities such as scoliosis, genu recurvatum, equinovarus feet and subluxation of the hip have occurred in patients whom I felt were adequately supported to carry out the activities that they had done with my permission. Each of these could have been modified by closer attention to the details of functional training and functional activity. The tremendous strides that all of us have made in increasing the functional capacity of severely involved patients is indeed commendable, but we are fre-

quently sobered by the realization that the increased functional capacity was gained at the expense of the later development of progressive deformities through overstress of skeletal system and progressive muscle weakness from persistent overwork.

Orthetic Devices

An orthetic device (orthotic is now being recommended for use) is the simple designation of any form of apparatus that is applied to a weakened bodily segment for support or assistance. Certain of these devices also are used to correct deformities of muscle imbalance or to adapt commonly used tools or utensils for use by the physically handicapped. The brace, crutch, corset, or wheelchair are examples of orthetic devices. Two outstanding examples of supportive devices are the long leg brace and the opponens splint. The long leg brace is applied to enable the patient with paralysis of the lower extremity to stand safely by maintaining the knee in extension and the foot in proper lateral alinement and dorsiflexion. It can be so designed that it assists the patient to properly position the hip in walking. When properly fitted, it prevents the development of such deformities as genu valgus or genu recurvatum.

The opponens splint is applied to hold the thumb in a position of abduction so that it can be properly opposed to the index and long fingers when the opponens pollicis and abductor brevis are paralyzed. This prevents stretching of these muscles and aids in recovery of strength and prevents contracture of the web of the thumb and distortion of the carpal-metacarpal and metacarpal phalangeal joints of the thumb. While both of these devices may actually assist the patient to better use the segments to which they are applied, the term assistive should be limited to those devices that actually contribute dynamic assistance to paralyzed or weakened bodily segments. The use of elastic material to extend the fingers in the presence of marked intrinsic or extrinsic weakness of extensor muscles is a good example of an assistive device. The so-called "artificial muscle" also is an assistive device. At best these devices are a poor substitute for voluntary control and strength in skeletal muscle, but when properly designed and fitted they can be used effectively to assist the recovery of strength, as well as to increase the functional capacity of a severely weakened segment.

Corrective devices depend on points of static or dynamic pressure to overcome limitations of joint mobility, musculotendinous contractures, or faulty alinement of skeletal structures. A turnbuckle bridging the space between the calf band and mid-thigh band of the long leg brace to obtain forceful flexion or extension of the knee is a good example of this type of apparatus. The finger and wrist extensor splints used on the hemiplegic hand to overcome the tendency to contracture of flexor muscles is another example. It is important to emphasize that if corrective devices are to be effective, they must be capable of applying resistance and accurate pressure in such a way that the patient can tolerate their use for many hours a day. This must be a gentle and persistent force applied day and night and removed only for bathing and specific treatment. Uncomfortable pressure points not only cannot be tolerated by the patient but may cause additional deformity through the patient's attempt to ease his position while in the device.

Many hundreds of adaptive devices exist for the handicapped. These range from the very simple addition of a suction cup to a nail brush so that the hemiplegic can scrub his hands, to elaborate devices to attach to industrial machinery to enable a skilled but handicapped craftsman to return to his former employment.

Abuse

Orthetic devices have at least five major dangers.

1. They may actually limit the extent of recovery in muscles for which they are designed to support and protect. No device that I know of can properly simulate the function and use of normal bodily segments. In general, they must be applied to weakened bodily segments

in a way that while supporting the skeletal structures and protecting the muscular tissue, they also limit the use of these tissues. Many braces, hand splints and corsets are used unnecessarily or applied for too long a period of time. The inherent restriction imposed on bodily segments by those devices limits the normal functional use of muscle, causes disuse atrophy, and may never give a muscle capable of recovery a chance to recover strength through use. There is too great a tendency, particularly in large crippled children's clinics, to simply check the fit and alinement of braces without rechecking the strength of underlying muscles to determine if the apparatus can be favorably modified or removed entirely.

2. Orthetic devices may increase muscle imbalance. This is particularly true of assistive devices if the elastic material designed to assist weakened segments to move through functional ranges acts as a very efficient resistance to further increase the strength of the opposing muscle groups. An excellent example of this is the spring loaded drop-foot splint designed to maintain the foot in dorsiflexion, but in practice acts as a very efficient exerciser for the already too strong triceps surae.

3. Probably the greatest fault that we have to find with orthetic devices is their capacity to cause musculoskeletal deformity. For the most part these deformities can be directly attributed to poor designing and fitting of the apparatus. If the weakened extremity is improperly positioned within the device, certain deformities will eventually develop. A long leg brace improperly designed or fitted can cause dislocation of the hip, if it persistently thrusts the thigh laterally during weight bearing. It can cause an anterior bowing of the femur if the upper thigh band does not fit high enough. It can cause either a flexion contracture of the knee or a genu recurvatum if the thigh bands or kneecap are improperly designed and fitted. It can cause genu valgus if the medial upright is improperly fitted. Improper attachment of the shoe to the brace can cause the development of any of the structural deformities that we see in the foot and ankle. An improperly placed pelvic band can cause flexion and abduction contractures about the hip and lateral deviations of the spine. The airplane splint can cause extensive contractures about the shoulder girdle and lateral deviations of the spine. The very fact that these devices are capable of correcting deformity simply means that if improperly designed they are equally capable of causing deformity. It would be safe to say that any musculoskeletal deformity can be caused by improperly fitted apparatus.

4. Orthetic devices occasionally may cause weakness of muscle through overwork. I am not referring to the possibility that the very use of an apparatus will encourage the patient to increase his activity and thus overwork certain muscles, but rather to the fact that certain types of orthetic devices demand, for their use, repeated strong use of muscular tissue. An excellent example of this may be seen in the so-called "tenodesis hand splint." This splint was designed to be used by the patient with a traumatic quadriplegia at the level of the fifth and sixth cervical vertebrae. Patients with complete lesions at this level usually have loss of voluntary function in all of the muscles of the forearm and hand, except the radial wrist extensors. The purpose of this splint is to utilize the ability of the patient to dorsiflex his wrist with his radial wrist extensors and through the mechanics of this splint oppose his fingers towards his thumb. When properly designed and fitted, the effect of this splint is quite dramatic and satisfying. The patient can bring his fingers away from his thumb by dropping his hand into wrist flexion through the forces of gravity. Then, by dorsiflexing his wrist he can grasp and pinch quite effectively. As long as he maintains contraction of the radial wrist extensors, he can hold objects in his hand. The inherent danger in this type of splint is in the fact that it requires the persistent use of one group of muscles. Unless the splint is light and very easy to activate, there is constant danger of overwork weakness developing in the only muscles that the patient has in his forearm.

5. Orthetic devices may cause pressure necrosis and ulceration. Persistent

pressure against muscle masses may cause extensive fibrosis and actually limit the functional capacity of the muscle. This is particularly true of the calf band of a long leg or short leg brace, pressing against the belly of the triceps surae muscle. Because of this, apparatus must be designed and fitted so that these unnecessary pressure points do not exist. Orthetic devices also are capable of causing pressure necrosis and ulceration of the skin and underlying tissues, particularly in patients with diminished sensation. Long leg braces are apt to cause such ulcers at the ischial tuberosity, the greater trochanter, the knee, and the ankle. Back braces very frequently cause pressure areas over the anterior-superior spine or over the sacrum. Hand splints, particularly when dynamically powered, frequently cause necrosis of the finger tips. For example, the artificial muscle applied to a hand splint to bring about flexion of the fingers against the thumb is capable of developing very considerable pressure. Unless this pressure is modified, and the design of the hand splint is such that firm pressure of the fingers against the thumb is not possible, pressure necrosis of the finger tips can occur very quickly. Unfortunately, we have been unable to develop any type of feed-back mechanism that warns us when undue pressure exists between fingers that have lost sensory perception and the objects that they are tightly holding. Eventually, some type of mechanism will be developed that automatically will release tension when dangerous pressure builds up.

Conclusion

At best, this has been but a sketchy outline of the use and abuse of certain agents commonly used in the field of physical medicine. I have tried to emphasize only those points of use and abuse in the tools of physical medicine that I use most often in my own personal practice. Each of these tools is essential in the most adequate care of most neuromuscular and musculoskeletal diseases. Perhaps I have been unfair in overemphasizing their abuse, but I have felt that there are many papers and texts written on the use of these tools, but very few written on their abuse. I have attempted in no way to decry their use by emphasizing their abuse, but rather to indicate there is more truth than poetry in the old saying "the brighter the light, the darker the shadow."

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Adrenocortical Steroid Therapy for Rheumatic Diseases

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● The management of rheumatic diseases has been greatly facilitated by the use of available adrenocortical hormones, their synthetic analogues, or ACTH, but careful attention to varying requirements of the disease and the individual patient is indicated. There is still room for improvement in the treatment of rheumatoid arthritis as well as certain other rheumatic diseases for which steroid therapy may be useful and helpful, and undoubtedly much will be learned regarding the appropriate use of the steroids with further experience. However, for the rheumatic diseases for which steroid therapy may be indicated and helpful, the several adrenocortical steroids currently available can now be useful and reasonably safe adjunctive therapy when used to best advantage within the limits of tolerable doses and as a supplement to the beneficial measures of nonsteroidal therapy.

The adrenocortical hormones, cortisone and hydrocortisone and their synthetic derivatives, prednisone, prednisolone, methylprednisolone, triamcinolone, and dexamethasone, and adrenocorticotropic hormone (ACTH) are "more versatile than any other hormonal agent."[1] These hormonal preparations have both specific hormonal value and nonspecific hormonal effects. The most important nonspecific effects which have been useful clinically are the anti-inflammatory and antirheumatic properties. These nonspecific hormonal effects are suppressive rather than curative, but this does not negate their usefulness. As Hench[1] has stated, it is no longer *if*, but when, how and for what purpose should these hormones be used.

Much additional investigation still is needed to answer questions pertinent to the clinical application and potentialities of these hormones, and their synthetic analogues; but for the present, appropriate application of currently available information and experience concerning use of the various preparations can appreciably improve their clinical effectiveness.

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Evolution of Antirheumatic Steroids

The various antirheumatic steroids now available are the result of efforts to separate their many physiologic effects and thereby improve their clinical usefulness.[2]

Cortisone was the first adrenocortical steroid found, in 1948, to have antirheumatic and other physiologic effects.[3] This was followed in 1949 by hydrocortisone which had a more certain local action but was equivalent to cortisone in the production of undesirable metabolic effects when given systemically.[4, 5] In 1954, 9-alpha-fluorohydrocortisone was found to have an antirheumatic effect about 10 times that of cortisone, but its effect on electrolytes was about 50 times that of cortisone.[6] Thus, introduction of this derivative demonstrated that variations in chemical structure could separate certain of the hormonal effects. The predominant effect on electrolytes, however, made this preparation unsuitable for use in the rheumatic diseases, although it was of value in certain other conditions. In 1954, also, prednisone and prednisolone were found to have antirheumatic effects approximately four to five times those of cortisone or hydrocortisone on a milligram for milligram basis without enhanced effect on electrolytes.[7] In 1957, triamcinolone[8] and methylprednisolone[9] were introduced.

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These preparations had effects similar to or perhaps slightly greater, milligram for milligram, than those of prednisone or prednisolone. The newest addition to the list is dexamethasone, which became available in 1958.[10] This preparation has a potency of about seven to 10 times that of prednisone or prednisolone milligram for milligram. Undoubtedly in the future more compounds will be added to this list.

Since the newer steroids now available still have the capacity to produce the so-called side effects occurring from prolonged use of cortisone, hydrocortisone or ACTH, relative potency is actually less important than the specific dosage used for each rheumatic disease for which the steroids are indicated and for each individual patient with that disease.

Indications for Steroids in Rheumatic Diseases

An accurate diagnosis is of first importance whenever use of steroids is under consideration for rheumatic diseases[11] because they are helpful in some but not all rheumatic diseases. Adrenocortical hormones, for example, are not indicated for specific infectious or septic arthritis, osteoarthritis (except for occasional, intra-articular use of hydrocortisone or prednisolone), primary fibrositis or psychosomatic rheumatism. The steroids may be helpful for certain other rheumatic diseases, but generally other treatment will suffice: for the arthritis of serum sickness, salicylates, antihistamines and epinephrine often will provide adequate treatment. For acute gouty arthritis, colchicine — given orally or intravenously — or a short course of phenylbutazone often will be effective. For noninfectious bursitis or tendinitis of the shoulder, physical therapy, analgesics and sedatives, roentgen therapy or local injections of hydrocortisone or prednisolone generally will be sufficient to obviate the need for systemic steroid therapy. However, when such treatment does not produce satisfactory results, systemic hormonal administration may be used to advantage for patients with the rheumatic diseases of this category.

The systemic use of cortisone or related hormones is especially indicated and helpful in acute rheumatic fever, in "active," progressive rheumatoid arthritis or rheumatoid spondylitis when these diseases are not responding adequately to basic therapeutic measures, in flares or crises of systemic lupus erythematosus or dermatomyositis and in early periarteritis nodosa.

Choice of Steroid and Dosage[2, 11]

When steroid therapy is indicated, the choice of hormone and dosage to be used will vary first with the nature and severity of the particular rheumatic disease for which steroid therapy is indicated. The anticipated duration of hormonal therapy, the age and sex of the patient, and the presence or absence of associated medical conditions that may affect the risk of hormonal therapy also are important factors for consideration.

Short-Term Steroid Therapy. For an acute, self-limited rheumatic disease with potentially serious damage as a result of uncontrolled inflammatory reaction, such as acute rheumatic fever, it is possible and indeed most effective to use large suppressive doses for the relatively brief time that hormonal therapy is needed.[2, 11] The doses of adrenocortical hormones will vary somewhat according to the degree of the inflammatory reaction in different individuals, but, in general, higher doses may be used in such instances because treatment with the hormone is to be relatively short (usually less than two months). Patients with acute rheumatic fever, for example, may need up to 40 to 60 mg. or more of prednisone daily for several weeks (or equivalent doses of other steroid preparations), but as control of the inflammatory reaction is obtained, dosage should be reduced gradually and satisfactory recovery may be anticipated. Attempts to treat acute rheumatic fever with an arbitrary, fixed dosage schedule of steroids have not proved as satisfactory as the use of doses varied in accordance with the individual requirements for control of the inflammatory process.

In systemic lupus erythematosus large hormonal dosage also may be needed for a relatively brief period of severe exacerbations. Doses ranging from 20 to 100 mg. of prednisone a day may be required for a few days, but it is desirable to reduce the dosage progressively when the flare has been controlled and, if possible, to control the chronic manifestations of systemic lupus erythematosus by other (nonsteroid) measures.

Prolonged Steroid Therapy. When prolonged hormonal therapy is needed because of chronic disease, management is different from that for short-term therapy. The age and sex of the patient particularly become important factors in the determination of dosage. This is especially well illustrated by the use of adrenocortical steroids for rheumatoid arthritis.

Steroid Therapy in Rheumatoid Arthritis[2, 11]

Selection of patients with rheumatoid arthritis for management with steroids is generally based on three principal considerations:

1. The rheumatoid arthritis should be in an "active" or inflammatory phase. Symptoms due to overuse of affected joints, chronic fatigue, emotional upset or other factors, for example, may not be indicative of the degree of inflammatory reaction present. Elevation of the sedimentation rate may not adequately reflect the extent of the inflammatory reaction and should not be used as the sole indication for steroid therapy. A period of careful medical observation for several weeks or months or even longer is sometimes needed to permit an adequate assessment of the inflammatory reaction of the rheumatoid process. The adrenocortical hormones suppress manifestations of "active" disease but have little if any effect on structural damage already present in affected joints.

2. Steroid therapy is best suited for use as a supplement to, rather than as a substitute for, the appropriate use of indicated conservative measures. The latter include the regular use of appropriate physical therapy, adequate protection of affected joints from overuse, optimal use of salicylates or other analgesics and recognition of the importance of extra rest, as these measures may suffice for the control of the disease in many patients with rheumatoid arthritis.

3. The benefit which one might reasonably anticipate from hormonal therapy should be sufficient to justify the possible risks and expense of such treatment.

Principles of Dosage.[2, 11-13] When long-term hormonal therapy is undertaken for rheumatoid arthritis, dosage schedules need to be highly individualized and flexible within the anticipated range of tolerance of the individual patient. Increasing experience with long-term administration of adrenocortical hormones for rheumatoid arthritis has indicated that tolerable doses are generally less than those previously considered satisfactory. Dosages vary with different steroid preparations because of differences in relative potency, but also and more particularly, they need to vary because of the patient's age and sex. For postmenopausal women, who are generally especially sensitive to effects of adrenocortical steroids, the average maximal daily dose that will be tolerated for long-term administration may not be in excess of 25 to 30 mg. of cortisone or hydrocortisone, 4 to 5 mg. daily of prednisone or prednisolone, triamcinolone or methylprednisolone and only about 0.8 mg. a day of dexamethasone. For emmenic women, who generally are somewhat less sensitive to the effects of adrenocortical steroids than postmenopausal women, the upper limits of daily dosage may not be in excess of 30 to 35 mg. of cortisone or hydrocortisone, 6 to 7 mg. of prednisone, prednisolone, triamcinolone or methylprednisolone and about 1.0 mg. of dexamethasone. For adult men, who generally tolerate steroid dosage better than women, the upper daily limit might be 40 to 45 mg. of cortisone or hydrocortisone, 8 to 9 mg. of prednisone, prednisolone, triamcinolone or methylprednisolone and about 1.3 mg. a day for dexamethasone. Some patients of both sexes may tolerate daily doses that are somewhat larger than the average maximal values just cited, but other patients seem unable even to tolerate doses within these limits. Improvement

in antirheumatic effects reported at times on changing from one steroid to another apparently often results from relative differences in dosage or other factors in treatment rather than from significant differences in antirheumatic effects of the various steroids. Use of ACTH to "stimulate latent adrenocortical function" has not in our experience sufficiently facilitated recovery of both adrenocortical and pituitary function to be a useful adjunct in long-term adrenocortical hormonal therapy.

Optimal antirheumatic effects with long-term administration of adrenocortical steroids are generally more easily accomplished if the initial, large, stimulating doses are avoided and the smallest possible dose of the hormone is given both at the start of, and during the course of, hormonal therapy. Gradual, small reductions of the dosage are anticipated and undertaken at varying intervals in accordance with the progress of treatment, but reductions may need to be of the order of 2.5 to 5.0 mg. if cortisone or hydrocortisone is used, from 0.5 to 1.0 mg. if prednisone, prednisolone, methylprednisolone or triamcinolone is used and from 0.05 to 0.1 mg. if dexamethasone is used. The objectives of steroid therapy are accomplished more readily if rheumatoid patients anticipate that sooner or later the inflammatory manifestations of their disease may be controlled adequately with gradually decreasing hormonal dosage or even ultimately without supplemental hormonal therapy in some instances.

Optimal use of antirheumatic steroids in tolerated doses may be facilitated by dividing the doses approximately equally throughout the 24-hour period and administering the hormone on a regular six or eight hourly schedule. For some patients irregular doses on a regular six or eight hourly schedule may be more satisfactory, but the irregular administration which may result from use of steroids "at meal time" or "three" or "four times a day" often results in the use of doses in excess of the minimal requirement because the interval between doses is irregular and in some instances too great. In any event all adjustments of dosage should be undertaken with the objective of always using the smallest possible dose at all times.

Intra-articular Use of Hydrocortisone or Prednisolone. Appropriate intra-articular use of effective antirheumatic steroids often can be a suitable means of keeping the total dose of systemic steroid therapy at low levels. Intra-articular steroid therapy, however, is most satisfactory when only one or a few accessible joints are affected or are refractory to otherwise satisfactory therapy. It is desirable to avoid the intra-articular as well as the systemic use of large doses and to avoid injections of multiple joints at one time when this would result in a large total dose with stimulating, systemic effects. Intra-articular use of steroids is not advisable to permit overuse of an affected joint because this may accelerate articular damage just as the systemic use of doses in excess of the rheumatoid patient's tolerance will.

Chronic Hypercortisonism[12, 13]

The primary reason for using doses of adrenocortical steroids within the limits mentioned is to prevent hypercortisonism. The term, "hypercortisonism," describes the exaggerated physiologic hormonal effects of overdosage of any of the adrenocortical steroids included in this discussion, or of ACTH. The effects of overdosage (or lowered tolerance on the part of the patient) are essentially the same for all of the antirheumatically effective steroid preparations now available commercially.

In patients with rheumatoid arthritis, chronic hypercortisonism is characterized by both general and special effects. The general effects are those characteristic of Cushing's syndrome including facial rounding, deposits of fat, acne, hypertrichosis, striae, osteoporosis with or without fractures, hyperglycemia, hypertension, aggravation of peptic ulcer and others.

Special effects of chronic hypercortisonism in patients with rheumatoid arthritis (or perhaps certain other inflammatory mesenchymal diseases) generally follow an initial period of stimulating effects of the hormone and generally are associated with at least some of the usual

or general effects of overdosage described. In addition, varying degrees of fatigability, emotional instability and generalized muscular and articular aching appear cyclically. At times the generalized aching may be mistaken for a flare of rheumatoid arthritis and erroneously treated by increasing the steroid dosage, which thereby prolongs or aggravates the reactions of hypercortisonism. The special effects of chronic hypercortisonism often are accentuated when the time is greatest from the last dose of the hormone and may be improved partially, but only temporarily, by the next dose or by increases in dosage. However, successive increases in dosage of steroids aggravate, if they do not complicate, the course of chronic hypercortisonism in rheumatoid patients.

The muscular and articular aching of chronic hypercortisonism usually can be differentiated from the discomfort of a flare of rheumatoid arthritis. Symptoms of increased articular inflammation of a rheumatoid flare are referable particularly to joints and fibrous tissue. The musculoskeletal symptoms of chronic hypercortisonism, however, are more diffuse, more generalized and more referable to muscles than to joints and fibrous tissue. They are not accompanied by increased synovitis but usually are associated with generalized hypersensitivity and hyperalgesia not characteristic of the rheumatoid patients prior to chronic hypercortisonism. Extra rest may make the fibrositic symptoms of a true rheumatoid flare worse temporarily, but it generally benefits the diffuse cyclic aching of chronic hypercortisonism. Use of salicylates and physical therapy generally are more helpful for a rheumatoid flare than for the symptoms of chronic hormonal intolerance. The sedimentation rate of erythrocytes may be increased in chronic hypercortisonism as well as in a flare of rheumatoid arthritis and thus is not of much aid in the differential diagnosis in this instance. When a patient says "my arthritis is getting worse," careful analysis is needed to permit an accurate decision with regard to the indications for either lowering or raising temporarily the hormonal dosage.

Mesenchymal Reactions. Severe diffuse mesenchymal reactions also may develop as a result of chronic hypercortisonism in patients with chronic rheumatoid arthritis. These may simulate the mesenchymal reactions of either systemic lupus erythematosus or periarteritis nodosa. Signs and symptoms simulating those of systemic lupus erythematosus, including the presence of lupus erythematosus cells in the blood, have been found in 14 per cent of rheumatoid patients with chronic hypercortisonism. This is in contrast to the finding of lupus erythematosus cells in only 5 per cent of rheumatoid patients who have not been treated with steroid therapy or have had steroid treatment without signs of hypercortisonism.

The mesenchymal reaction of chronic hypercortisonism also may be present with the symptoms and signs of periarteritis nodosa, including the diffuse panarteritis histologically characteristic of periarteritis nodosa. Rheumatoid patients with this type of reaction may have peripheral neuritis, vascular occlusions, cutaneous ulcers, nephritis, hypertension, and leukocytosis in excess of what would have been anticipated without the development of intolerance to the hormone.

In some instances the severe mesenchymal reactions have been irreversible, and death has resulted. In others the reactions simulating rheumatoid arthritis, systemic lupus erythematosus or periarteritis nodosa are reversible with satisfactory reduction of the steroid dosage and subsidence of the hypercortisone reaction.

Inadequate Response to Stress. Patients with chronic hypercortisonism are vulnerable to the effects of acute adrenocortical insufficiency resulting from the stress of major surgical procedures, severe trauma or infections.[14] Under these circumstances steroid therapy generally should not be stopped or decreased, and in many instances should be increased to protect against this serious medical emergency. Such major stresses require more adrenocortical hormone than can be produced endogenously in such patients, but unfortunately the exact amount of supplemental steroid needed cannot be determined in advance of the stress. It, therefore, is advisable to be as certain as

possible that adequate amounts of supplemental steroid are made available. When operative procedures cannot be postponed until the hypercortisonism has subsided but are not performed as an emergency treatment, cortisone acetate is given intramuscularly in 200-mg. doses 48 hours, 24 hours and 1 hour before operation with gradual reduction of doses after the operation if further administration is required. In the event of an emergency operation or unanticipated trauma, hydrocortisone (free alcohol or succinate) can be used intravenously. The most critical period for patients following a surgical procedure or other severe stress is the first 18 hours after the operation or stressful event. Use of these doses of cortisone acetate to counteract endogenous adrenocortical insufficiency has not resulted in any impairment of wound healing or other postoperative complications related to steroid preparations. Following a satisfactory immediate postoperative period, the patient's previous oral dose of steroid may be resumed if needed.

When a minor operative procedure is contemplated, less extensive preparation may be satisfactory, but it is generally advisable to be certain that the patient's current dose of steroids is continued. An additional dose, given orally or intramuscularly, may be used in such instances if needed or if the extent of the trauma involved is somewhat unpredictable. In any event the patient should be carefully observed and treated for any signs of shock or circulatory collapse occurring either during or after an operative procedure or other severe stress.

As an additional protective measure rheumatoid patients or others receiving long-term hormonal therapy are advised to carry with other identification papers information regarding their steroid therapy.[12] Information containing pertinent data regarding dosage and duration of hormonal therapy can be written on a small pocket card which also may indicate the need for more steroids in the event of stressful accident or shock and the physician's name and telephone number. Rheumatoid patients are advised to carry information of this type for at least one year after hormonal therapy has been stopped and longer if hypercortisonism has been present.

Results of Treatment of Rheumatoid Arthritis[1, 2]

The results of treatment of rheumatoid arthritis generally are dependent on a number of factors which may make evaluation of the results of any given program of extended treatment difficult. However, in 50 to 60 per cent of the patients for whom hormonal therapy is indicated, conservative use of adrenocortical steroids and the acceptance of a degree of improvement possible within the anticipated limits of tolerable dosage for each patient probably will give satisfactory control — about 75 per cent control of the signs of "active" rheumatoid inflammation — and the dosage will be well tolerated. In another 25 to 35 per cent of patients the results may be worth while with about 50 per cent relief of inflammation, but the management of the patients in this group is more complicated. In about 15 per cent of the patients prolonged satisfactory control of the rheumatoid arthritis is difficult, if not impossible, to obtain with present limitations of dosage and administration. Effective control of the course of rheumatoid arthritis may be anticipated, then, when treatment is adequate, when it is instituted early, when it is continued conscientiously and, when it includes the use of steroids if indicated as well as other appropriate treatment.

Summary

The management of rheumatic diseases has been greatly facilitated by the use of available adrenocortical hormones, their synthetic analogues, or ACTH, but careful attention to varying requirements of the disease and the individual patient is indicated. There is still room for improvement in the treatment of rheumatoid arthritis as well as certain other rheumatic diseases for which steroid therapy may be useful and helpful, and undoubtedly much will be learned regarding the appropriate use of the steroids with further experience. However, for the rheumatic diseases for which steroid therapy may be indicated and

helpful, the several adrenocortical steroids currently available can now be useful and reasonably safe adjunctive therapy when used to best advantage within the limits of tolerable doses and as a supplement to the beneficial measures of nonsteroidal therapy.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

European Spas

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● European spas, frequented by the ailing for many centuries, today are being visited in increasing numbers by the sick and by those who desire to prolong their life span of useful activity. They are being referred by their physicians who consider spa therapy as an integrated part of the overall medical care of their patients. Modern technology is affording objective, scientific explanations for the observed clinical results.

The American public, both medical and lay, appears to have no conception of the magnitude of the spa movement in Europe. This movement on the European continent today is a dynamic and growing force. Spa therapy in Europe is represented by several thousands of doctors, many more thousands of therapists and other employees, treating millions of people and representing an investment of billions of dollars. It is supported by local and national governmental agencies, insurance associations, unions and private corporations as well as by the members of the medical profession. Spa doctors are organized in specialized local, national, and international associations. Spa affiliations include many of the leading European universities, primarily for purposes of research.

Illustrative of the trend of spa attendance in Europe are the statistics on patient days spent at the 24 institutions which form the Austrian Spa Association. These were 3,110,406 in 1955; 3,423,058 in 1956, and 3,732,860 in 1957. In 1957, the number of patient days of visitors from other countries was 1,347,397, or roughly about one third of the total attendance. The greatest number of these were from the German Federal Republic, and in diminishing numbers, the guests were from Switzerland, the Benelux countries, France, Great Britain, Italy, the United States, and some from other countries.[1]

In contrast with the physical expansion and increasing importance of the spas of Europe, the few we possess in our country have been diminishing in number and losing their meager support. What accounts for this sharply divergent opinion as to the efficacy of spa therapy? Could it be due to the fact that our medical schools do not give instruction in this division of therapeutics which European schools consider to be important? Is our evaluation more exact, more factual, or is it less so? Is it possible that we exhibit our ignorance of a large mass of described objective, as well as subjective facts concerning the effects of spa therapy by denying they exist?

With human ailments much the same on this side as on the other side of the Atlantic, we may find that we have something to learn from the more extensive experiences of our European confreres in this field. As the result of an inspection of several spas in the German Republic, Austria, and Italy, a review of their activities, discussions with their staff members, and perusal of their literature, we have gleaned some ideas which may account for the differences of opinion as to the value of spa therapy held by the medical practitioners and laymen of our respective parts of the world. We sent a questionnaire to each spa in advance of

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This article is the result of a tour of spas in Germany, Austria, and Italy made at the request of the respective Spa Associations and tourist bureaus and the World Travel Plan Inc., to evaluate the therapy available in these facilities. The tour was made in October, 1958, and was financed by the European Spas Associations and Lufthansa.

our visit. In their book, "Acque Minerali Del Mondo," Messini and DiLollo describe 1955 spas throughout the world.[2] Of these, 1212 or about 62 per cent, are on the continent of Europe. We visited 14 European spas: in Germany, Baden-Baden, Badenweiler, Bertrich, Freudenstadt, Kissingen, Nauheim, Neuenahr, Wiesbaden, and Wiessee; in Austria, Baden Bei Wien, Gastein, Hall, Ischl; and in Italy, Montecatini.

Most of the spas are open the year round, some only during the spring, summer and fall. They are each able to treat several hundred to several thousand patients a day. To do so, they maintain an adequate staff of physicians, therapists, nurses and attendants. Each individual spa, while interested in treating a variety of diseases, may give special attention to the care of one disease or group of allied diseases. Thus, Nauheim and Wiessee pay particular attention to cardiovascular disorders; Baden-Baden, Badenweiler, Wiesbaden, Gastein and Baden Bei Wien to rheumatic disturbances; Bertrich, Kissingen and Montecatini to abnormalities of the gastrointestinal tract; Bad Hall to arteriosclerosis and eye diseases; Freudenstadt to respiratory difficulties, and Neuenahr to metabolic abnormalities. About 50 per cent of the patients coming to Neuenahr suffer from diabetes.[1] Interest in a special disease at a given spa may be due to its location, its waters and other facilities, its past experiences, and to the medical specialists who care for its patients. Patients seriously disabled by disease or injury are not treated at spas, but at local hospitals.

The spas we visited are served by specialists in each of the diseases treated at the spa. These specialists, as well as the general practitioners in the spa area, are in insurance and private practice. They are not employees of the spa. After a complete examination (including, when indicated, laboratory tests such as electrocardiogram, radioactive iodine uptake, etc.) they prescribe the spa treatments and such other procedures as would be advised by a specialist in some non-spa area. In other words, they are practitioners who in addition to their specialized training and experience in medicine, have received further specialized training in the application of spa facilities.

No patient is treated at these spas without a detailed prescription by the doctor. This rule is rigorously enforced. In accord with usual practice, the referring physician informs the spa doctor of the medical history and pertinent findings concerning the patient. In turn, at the end of the course of treatment, the spa doctor sends back a report as to his findings, the treatment administered, and the patient's reactions and status at the time of discharge. During his three or four weeks of treatment, the patient usually will be seen by his spa doctor at the beginning, at about the middle, and at the end of his stay. Of course, if there be any need for it, he will be seen at more frequent intervals.

Many doctors send their patients directly to spa physicians whom they know. Those patients who are referred to the spa itself are given a list of doctors from which they make their choice. The source of referrals differs in various spas. Thus, while 90 per cent of the patients sent to Bad Neuenahr are directed there by their own doctors, 75 per cent of those coming to Bad Hall are sent by their insurance association. About 50 per cent of the patients going to the spas which are members of the Austrian Spa Association, are referred by the Social Insurance Association.[1] Recommendations by laymen, union referrals, and the influence of tradition and of public relations activities, account for the presence of different percentages of those going to the various spas. A high percentage of the people being treated at these centers are referred by physicians representing health insurance companies, social security agencies, unions, corporations, municipal governments, etc. Many of these maintain well equipped and well staffed sanitoria in conjunction with the spas. None of these organizations would spend such huge sums of monies unless they were sure that they could show a profit. These agencies remain solvent because the people who are sent to the spas usually can return to their former jobs and continue paying their insurance or social security. Thus, the State Insurance Fund of Hungary declared that its computed outlay for

therapy and compensation in the rheumatic group of diseases diminished 23 per cent through the use of spa therapy.[2] It is of interest to note that a totalitarian government like Russia is expanding its old spas and adding new ones.[1]

Spas are known to have been popular, in places like Bertrich and Badenweiler, since the days of the Romans, two thousand years ago. The social importance of "taking the waters" has disappeared and people come primarily for reasons of health. Many return year after year because they believe their health has been improved. The person of modest means can afford to go to the spas because of the moderate costs. Depending on the spa and the type of accommodation, the average all inclusive expenses for a three weeks stay will vary from about $100 to $250.

Spa Facilities

The basic reason for the existence of a spa is the presence of mineralized water coming from a spring. Each spa has made a detailed qualitative and quantitative analysis of the mineral and gaseous content of its waters, as well as its physical properties and temperatures. These may vary not only at different spas but in different springs at the same spa. The main classifications are: the saline, alkaline and mixed waters. The mineral contents include: sodium, potassium, calcium, ammonium, magnesium, lithium, iron, chlorides, sulphates and bicarbonites. The gaseous constituents are: carbon dioxide, hydrogen sulphide, radon (radium emanations), nitrogen and oxygen. The waters of these springs, passing as they do through volcanic and other earths, pick up traces of many substances. These include: aluminum, arsenic, barium, boron, bromine, caesium, chromium, cobalt, copper, fluorine, germanium, iodine, lead, lithium, manganese, nickel, rubidium, silver, strontium, titanium, vanadium, zinc, and zirconium. Because most of these mineral substances have been shown to be needed by the human economy, they have been referred to as "inorganic vitamins."[4] The consideration of trace mineral metabolism is receiving increasing recognition for its significance in the etiology and therapy of disease.[5]

Spa waters are applied in various ways: by drinking, by bathing and by inhalations. The prescription will indicate which spring water the patient is to drink, how much and when, the temperature, frequency and duration of the bath and whether it be a full, half or partial bath. Ingeniously shaped bath containers are in use. Some have an installation for the additional application of water coming out of a hose nozzle under sufficient pressure to cause an erythema within seconds (underwater massage). A clever arrangement for the administration of contrast foot baths consists in the use of two troughs in the floor, separated by a narrow partition. One holds cold water, the other warm; the patient walks through one, then steps over into the other, and so back and forth. Other forms of water applications consists of sprays, douches and irrigations, swimming and underwater exercises in pools. In Bad Gastein and in Montecatini there are natural grottos containing hot moist air. Nebulized water is used for inhalation. Mud baths are applied to local areas or to the entire body (with exception of the head). The temperature of the mud varies between 40 and 50 C. This mud is of volcanic (fango) or of vegetable (moor) origin. Following his bath, the patient is required to rest for about one hour.

Exercises are given to improve breathing, to increase the range and power of extremity motion, or for some other such special purpose. Graded walks of varying inclination and of known distance permit a measurable form of exertion. Those who are able to exercise in a normal vigorous fashion, can partake of such sports as: tennis, golf, riding, swimming, skating, skiing and dancing.

Massage is administered in its various forms, so-called "Swedish," "regular," and as "bindegewebs" (connective tissue) massage. The latter is a method of massage now popular in Germany. It is applied with a special technic to the head zones corresponding to the area to be influenced.

Diet instructions form an important part of spa care, particularly in metabolic diseases.

Relaxation is encouraged not only by the opportunity for rest after treatments and at other times, but also by different forms of entertainment. These include concerts during the day and evening, theatrical performances, cinema, ballet, opera, trips to nearby places of interest, etc. For those who desire to gamble, a few of the spas maintain casinos.

The various modalities employed in physical medicine in this country are available, but are used infrequently. The same end result is obtained at the spas by utilizing the mineral waters for heat and exercise; the parks for graduated exercises; and the humid hot air for analgesia and to increase range of motions of the joints.

Physiologic Action

The European spa physicians are keenly aware of the necessity to demonstrate objective, physiologic changes, to explain the clinical effects they have observed following spa treatment. Many research institutes have been established at the spas and at universities. These include: Bonn, Erlangen, Freiburg, Giessen, Mainz, Munich, and Würzburg in Germany; Graz, Innsbruck and Vienna in Austria; Florence, Genoa, and Rome in Italy. Research institutes at the spas include: the Kerckhof Institute at Nauheim; those on balneological research at Bad Gastein; on rheumatism research at Baden, near Vienna, and the Paracelsus Institute at Bad Hall. The results of these research activities have been described in an extensive literature, nearly all written in native languages. Illustrative of the research activities of a single spa are the 21 papers read at the 1958 annual meeting of The Hydrological Medical Association of Montecatini, on a day when we chanced to be present. The subject matter ranged from discussions on the intestinal absorption of $S^{35}O_4$ and Na^{22} in saline-sulphate-alkaline waters in animals poisoned with carbon tetrachloride, to the thermal treatment of diseases of tonsils and pharynx in children.

Many of the changes in human physiology caused by the application of spa procedures are the same as those that occur universally following the use of water, heat and cold, elevation of body temperature, massage, exercise and other physical measures, and relaxation. They have been described in numerous texts.

The fact that spas have existed for many years and that they are expanding their activities in Europe, points to the possibility that they do possess some unusual therapeutic advantages. In the past, many of the claims made for the superiority of spa therapy have been on the basis of post hoc and ergo propter hoc. With the development of modern research technics, explanations have become less conjectural and more factual. Much of the experimental proof had to wait for the availability of the investigative technics which have been developed since the beginning of this century in the fields of physics and chemistry, such as electrocardiography, radioactivity, microchemistry, polarography and emission spectrography. It may well be that this trend will continue with the creation of investigative procedures unknown at present, and with the further application and elaboration of those known today.

In the past, critics have explained away the expressions of subjective improvement as imaginary. Today, particularly due to the work of Selye,[6] we understand that our minds can influence our bodies. It is now generally realized that, "the mind is its own place, and of itself," can create or erase, minimize or magnify, physical as well as psychic disability, and assist other agencies to secure the desired relief.

There is universal agreement that a sojourn at a spa can have a beneficial psychologic effect. This may result from several factors, some of which are specially related to spas, while others are common to vacations in general. In the latter category are: removal from the usual surroundings of home and business, with the lessening of associated tensions; the stimulus of a more agreeable climate; picturesque places and new faces; the relaxation resulting from being waited on, instead of serving oneself and others;

and participation in pleasurable activities. These influences likewise exist at spas and, possibly, with added significance for the person suffering from some chronic illness who might hesitate to venture into new places devoid of the facilities for the medical care he might require.

At spas, in addition, the atmosphere is charged with hope. As beauty is in the eye of the beholder, so to the chronic sufferer, the ornate, spacious and artistically decorated structures set in beautiful gardens and often with enchanting vistas, may appear not as ordinary buildings, but as temples of healing whose contained beneficent powers will be extended to him. His optimistic expectations are heightened by the examination of the specialist to whom he was referred; by the detailed list of instructions he receives to schedule every hour of his day, with explicit directions as to his diet; by the time and quantity of the spring waters he is to drink; by the type and duration of his bath, with the period of relaxation after it; by the nature and extent of his exercise; by his massage, and by such other measures as his doctor considers appropriate. During the application of his massage and other treatments, the "laying on of hands" may give a subconscious boost to his will to become well. Additional boosts are received by discussions with his fellow spa visitors; by the sports or walks in which he can participate; by the frequent concerts, chamber music, theatrical and operatic performances and by other forms of entertainment. It might well be considered that if the value of a stay at a good spa could be attributed to nothing else but its psychic influence, there would still be ample justification for its recommendation. There are, however, many other reasons. Some of these will be indicated in the following discussions.

Rationale For Treatment of Various Diseases

The doctor should consider spa treatments not as a specific remedy for a particular disease, but as another important approach in the over-all care of his patient. The primary influence of spa therapy is on the constitution as a whole. European physicians appreciate the need for a cooperative effort with the spa physician functioning as other specialists do, to augment the activities of the patient's doctor. They realize that there should be no antagonism between medical practice in and outside of the spas. It is understandable why the American physician bristles when he hears the word "cure" applied to the activities of the spas. To the European doctor, the German word "kur" (which is translated into English as "cure") is synonymous with the word "treatment." It does not mean the complete disappearance of a disease. It is unfortunate that terminology is not standardized between physicians speaking different languages. What we refer to as a "Spa" is termed in German as a "Kur" or "Bäde Ort" (a treatment or bathing place), and in Italian as a "Terme." In Europe, the word "Spa" is the name of a small place in Belgium where "spa" facilities exist.

The greatest percentage of patients coming to European spas suffer from rheumatic and cardiovascular disorders. About 2,000,000 people attended the spas of the Federated German Republic in 1956. The statistics available in the German Republic indicate that of the persons referred to spas by the government insurance agency during one year, 25 per cent suffered from rheumatism; 21 per cent from diseases of the heart and blood vessels; 21 per cent from respiratory diseases; 12 per cent from digestive tract disorders; 8 per cent from conditions causing exhaustion and small percentages due to nervous, gynecologic diseases, diabetes, etc.[7]

Rheumatic Disorders

For centuries, it has been common knowledge that persons suffering from "rheumatism" do feel better after a stay at a spa. As in the treatment of other disorders, a stay at a spa is considered to be a therapeutic episode (frequently an annual one) in the long term care of the rheumatic patient. The over-all medical responsibility for the patient's welfare remains in the hands of his home doctor who directs the pre- as well as the post-spa management. Spa therapy is not considered as displacing other recog-

nized therapeutic measures such as the use of salicylates, gold and steroids, unless the degree of improvement obviates their need. The possibility of reducing the amount of medication required, is indicated by a study made at the University of Vienna, utilizing the facilities of Baden near Vienna. After a four week course at the spa, the medical histories of 40 patients were checked during a period varying from two to five years. These patients had been taking an average of 10 to 15 mg. of prednisolone daily. There was a significant drop in the quantity of steroids required amounting to about one third less.[1] Evers reported on a group of 100 insured patients, 70 per cent of whom were unable to work when admitted to a course of baths containing sulphur waters. At the end of the course, only five per cent remained too disabled to work.[8]

It has been recommended that while spa treatment be started as soon as possible in the care of primary chronic rheumatoid arthritis, it should be deferred for six to eight weeks after the fever has abated in a case of acute rheumatoid arthritis. An increased sedimentation rate is not of itself a counter-indication to spa therapy; bony ankylosis is. Procedures which are relatively mild are applied to patients whose reaction is hyperactive, and to arthritics suffering from additional difficulties such as chronic insufficiency, hypertension, asthma and emphysema. Spa care is indicated for osteoarthritis and for gouty arthritis.[8]

The rationale for the procedures employed at spas in the treatment of rheumatic disorders has been explained on the basis of various physiologic changes. The buoyancy of water, further increased by its mineral content, permits a larger range of joint motion. So does the muscle relaxing influence of the water's warmth and the underwater massage. When placed on a local area, mud is an effective means of applying conductive heat. When used to cover the body, it can produce an elevation of systemic temperature with resultant profound changes in all body activities.[9, 10] Mineral substances are taken into the body when drinking the waters. They can also be introduced through the skin, as determined by radioactive isotope studies. Radioactive sulphur, for example, has been demonstrated in the skin, subcutaneous tissues and in joints.[8] While sulphur is utilized for the production of chondroitin H_2SO_4 of cartilage, one cannot say that it has a specific action.

A striking phenomenon is the so-called "bath reaction." This may take place at the end of the first or second week of the treatment or even later. It is characterized by an aggravation of symptoms, loss of appetite, sleeplessness and depression. Objectively, there has been noted an increase in sedimentation rate and a change in the electrophoretic pattern of the serum with a decline of the albumin content and an increase of the gamma globulins. Toward the end of the treatment, there is a rise in the albumins and a decline in the gamma globulins; the copper level declines; and the hyaluronidase activity of the serum approaches normal values. Other physiologic changes produced by sulphur baths are alterations in the activities of the thyroid, liver and adrenals and increased production of vitamin C.[8]

Cardiovascular Disorders

The natural CO_2 bath is considered to have special merit in the treatment of the cardiac patient because of its unique ability to cause vasodilatation of the cutaneous blood vessels without any increase in the work of the heart, such as would occur in a warm bath causing an equal vasodilatation. On the contrary, the CO_2 bath reduces the work of the heart. Though administered at a neutral temperature, the CO_2 bath gives the sensation of warmth because of the insulating layer of gas bubbles next to the skin. It has been found that the carbonic acid dissolved in a natural CO_2 bath diffuses through the skin at a rate of about 30 ml. per minute. The skin hyperemia is due to released histamine and acetylcholine. As a result, the pressure in the afferent capillary loop is increased about four times; the venous capillary pressure increases; the deep venous plexuses of the skin are emptied; and the increased vascularity of the skin

drains the splanchnic pool. The diastolic pressure and the heart rate are lowered. In addition, the hydrostatic pressure exerted by the bath, improves the venous return flow through compression of the lymph channels and veins.[8]

Various technics are employed for the application of CO_2 baths. When administered as a partial, or half bath, no pressure is exerted against the thorax. Ingenious apparatus has been constructed to permit the administration of CO_2 baths to cardiacs in the sitting position and without any water pressure, as in a vapor bath.

The existence of springs of different chemical composition at the same place, permits of the more ready treatment of associated symptoms. Thus, the cardiac suffering from chronic constipation, may benefit additionally by the drinking of sulphate waters.

Professor Weber emphasizes the importance of observing the patient's reactions after the first bath and during the entire course, and varying the technic in accordance with the response.[1] He considers that the main indications for the CO_2 bath are the treatment of conditions due to sclerotic changes of the coronaries, and of hypertension. Evers[8] advises its use in the treatment of effort syndrome, slight decompensation, sequelae to endocarditis and to myocardial damage, arrhythmia with circulatory disturbance, tachycardia due to hyperthyroidism, chronic pericarditis and peripheral circulatory disorders such as arteritis obliterans and those occurring in diabetes. The list of contraindications includes: serious decompensation; advanced sclerosis, A-V and bundle branch heart block; phlebitis; pulmonary oedema; fixed hypertension, and diseases associated with hemorrhage. One is advised to wait four to six months after coronary and hemiplegic attacks.[8]

The staff at Bad Hall (and the associated Paracelsus Institute), consider that because of its iodine content, their waters have special remedial value. Following its use, they have observed cardiac improvement, with a diminution of pulse wave speed, of peripheral resistance, stroke and minute volume, and a lowering of blood pressure in hypertensives. They stated that in about 50 per cent of the patients suffering from intermittent claudication, marked improvement occurred as judged by objective testing by oscillometry, radiography and skin temperature, and even a higher percentage as evaluated subjectively. The remedial effect lasted for five to six months before it began to disappear.[1]

Researchers at Montecatini found that saline-sulphate-alkaline waters lowered the serum lipoprotein levels in rabbits whose livers had been damaged with carbon tetrachloride, as well as in those overfed with fat or given cortisone. Observations on patients suffering from liver dysfunction, and on volunteers on a high fat diet, showed a reduction in lipoproteins. There was an increase in heparinoid substances in the plasma and an increased synthesis of phospholypids labeled with p^{32}, with evidence of a resultant protective effect against infiltration of the aortic wall and of the liver.[1]

Gastrointestinal Disorders

The spa approach to the care of disturbances of the gastrointestinal tract is a quadruple one—dietetic, constitutional, chemical and physical. In many spas, not only is the patient told what to eat and what to avoid, by the doctor, assisted by the dietician, but also the local cooks in the small boarding houses as well as in the large hotels are instructed in regular diet courses which are repeated every year. The psychologic influences, the tonic effects of the baths, massages and exercises; and the relaxation technics tend to minimize the tensions which in many instances may be contributing to the cause and continuation of the presenting malady.

In chronic gastritis, the ingested waters, be they alkaline, alkaline-muriatic, sulphated alkaline, or mixed bicarbonates, are said to liquify mucus, remove inflammatory exudates, and stimulate secretion, absorption, and motility. Alkaline waters inhibit the secretion of acid and neutralize the acid formed. Carbonated waters are acid provocative. In hyperchlorhydric gastritis, the sulphated alkaline waters reduce the hypersensitivity of the gastric mucosa, whereas in hypochlorhydric gas-

tritis, thermal saline waters are administered. Cold drinks stimulate the secretion of hydrochloric acid and the contraction of the stomach muscles, while warm drinks have a sedative effect. After gastric surgery, at least six weeks should elapse before the inauguration of spa treatment. Physical procedures include mud packs to the abdomen and warm baths. Spa therapy is contraindicated in acute gastritis, bleeding ulcers, neoplasms and pyloric stenosis.[8]

Diseases of the liver and gall bladder are treated with dietary, drug, and general and local physical measures. Reliance is placed on spa waters for their cholagogue action. Researchers on dogs in whom a biliary fistula was established, and in humans with such a pre-existing fistula, demonstrated an increase in bile flow. The action of the salts caused contraction of its musculature and the emptying of the gall bladder with relaxation of the sphincter of Oddi.[8] Experiments on dogs have shown that spa waters can cause regeneration of liver cells. The content of cholesterol can be increased in the bile and diminished in the blood. Abnormalities of the liver considered suitable for spa therapy, include enlargements of the liver (except congestive manifestations in cardiacs), mild forms of hepatitis, hepatic lesions resulting from infections or poisoning or due to excessive use of drugs (e.g. chincophen), and remittent jaundice. This therapy is contraindicated in cirrhosis, neoplasms, and acute infections. Pathologic states of the gall bladder and its ducts, not requiring surgery, are stated to be favorably influenced by spa care. Cholangitis and cholecystitis are so treated. Grocco claims good results in some cases of cholelithiasis.[11]

Spa therapy is advised for chronic enteritis, mucus colitis, and for the sequelae of intestinal infections, such as dysentery. The spa approach is considered important for the treatment of constipation. In addition to the drinking of the waters, dietary and bowel habit training, hot mud applications and underwater intestinal baths are employed. Warm hypertonic plain saline waters are indicated for spastic constipation, and hypertonic sodium sulphate waters for constipation due to defective movements of the colon. On the basis of many experiments and extensive clinical experience, Messini asserted that hydrologic treatment can modify hepatic function, as determined by many biochemical changes. These changes in the digestive tract and in the liver, caused a decrease in the general symptoms which are allied to constipation.[12]

Respiratory Diseases

For the American doctor visiting a European spa for the first time, possibly nothing accents the differences between medical practice in this country and abroad, as much as the sight of a long row of special apparatus used for the treatment of respiratory diseases by means of inhalation. The waters are administered by themselves or with various added ingredients such as ephedrine, eucalyptus, and penicillin. A negative electric charge can be imparted to the water particles. Also, the air pressure may be increased or decreased in pneumatic chambers. The aerosols are applied through individual apparatus, or patients may be treated in groups as they sit in a special room, the air of which is filled with the nebulized waters. Gases such as CO_2, H_2S, and radon may also be inhaled.

The experimental and clinical considerations in inhalation therapy are discussed in a large literature including a special journal, "Zeitschrift Für Aerosol-Forschung Und Therapie." The factors considered in the administration of nebulized sprays are the content of active principles, and the quantity, density and degree of vaporization. The maximum effectiveness in a given area of the respiratory tract is determined by the size of the droplets. This varies from 0.02 to 100 microns. Six grams of chemical substance may be absorbed in 30 minutes by inhalation.[13] Administration of negatively charged ions improves the functional efficiency of the trachea. The ciliary rate and mucus flow are increased.[14]

The conditions treated include chronic and atrophic rhinitis, sinusitis, ozena, chronic laryngitis, chronic bronchitis,

bronchiectasis, asthma and emphysema. Utilizing the isotonic sodium chloride waters in Wiesbaden, Himstedt reported favorable and rapid results in the treatment of 2,000 patients suffering from bronchitis, asthma, whooping cough and bronchiectasis.[15] The increased expectoration was particularly significant. Approximately 10 inhalations were given to each patient. Contraindications to inhalation therapy are acute infections, tuberculosis and new growths.

In the treatment of respiratory conditions, use is made not only of inhalations, but also of pneumatic chambers, baths, drinking waters, and respiratory exercises. The climate of the spa is considered to be of particular importance. This factor alone may be adequate to give relief for chronic respiratory catarrh due to external irritants, such as smoke, dust and gases.

Metabolic Disorders

Spa treatment can reinforce the dietetic and insulin therapy of diabetes. The reduction of hyperglycemia and glycosuria is attributed to several factors: to the direct action of the waters in increasing the production of insulin and of muscle and liver glycogen and to the influence of exercise and of the psychologic and climatic factors.[8]

Uric acid excretion is increased in gout by alkaline waters, calcium sulphate and calcium chloride waters. The care of the arthritic involvement is along the lines of that followed in rheumatoid arthritis.

The obese individual can lose weight more readily at a spa because of the stricter dietary control; the changed environment, the baths, the waters, prescribed exercises, sports, and other spa amenities.

Urinary Disorders

The diuretic action of mineral waters accounts for their use in the treatment of pyelitis and inflammation of the ureters, bladder and urethra. In the presence of renal calculi, spa therapy is applied with the expectation that the action of the waters, the baths, the diet and environmental changes will encourage the passing of small stones and relieve the concomitant inflammatory manifestations. Mud packs are applied locally to aid the process. After surgical removal of calculi, such as urate stones, where the urine is acid, alkaline waters are administered to cause a shift to the alkaline side.

Gynecological Diseases

If there is no improvement from hormonal therapy, Mikulicz-Radecki recommends spa treatment for amenorrhea, scanty menstrual flow, dysmenorrhea, menopausal disorders, and sterility due to endocrine deficiency or to genital hypoplasia with otherwise normal ovarian function. The purpose of the intensive course of baths and mud packs is to increase the local blood supply. For chronic inflammation of the uterine adnexa and the parametrium, peat baths are used in addition to sulphur and brine baths.[8]

Diseases of the Skin

As in the treatment of other conditions, spa therapy for skin diseases is considered as supplementary to the care given before and after it. Hot or cool waters and muds containing sulphur, arsenic and other chemicals are advised for the treatment of prurigo, pruritis (including that occurring in old people), lichen ruber, psoriasis and eczema. For most varieties of eczema, the general treatment is considered more important than the local, because of the presence of allergic factors.[8]

Diseases of the Nervous System

The facilities which spas offer can relieve the symptoms of the individual suffering from functional nervous disorders. Spa neurologists also treat organic abnormalities. They prescribe sulphur baths and packs for the neuralgias due to poisoning with metals (such as lead and mercury) and underwater and other exercises and physical therapeutic procedures for those conditions characterized by a loss of motor ability and the presence of pain.

For centuries, the practitioners at European spas have recognized the con-

cept of what might be termed, "habilitation medicine." They have advised the individual with no specific complaint so that he may live as long and as useful a life as he can. "Spa treatment" as Evers describes it, "is a valuable and reliable form of treatment for improving the constitution, shortening the period of convalescence after serious illness, preventing premature senility, and for prolonging active life. The important thing in this connection is not to cure localized organic disease, but to promote the physical and psychologic well-being of the whole constitution and to restore the patient to full health. Many a spa has been renowned for centuries as a fountain of youth."[8]

Summary

European spas, frequented by the ailing for many centuries, today are being visited in increasing numbers by the sick and by those who desire to prolong their life span of useful activity. They are being referred by their physicians who consider spa therapy as an integrated part of the over-all medical care of their patients. Modern technology is affording objective, scientific explanations for the observed clinical results.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

VERY IMPORTANT

The next examinations, written and oral, of the American Board of Physical Medicine and Rehabilitation will be held in New York City, June 24 and 25, 1961. The final date for submitting application is February 15, 1961. Write to the Secretary, Dr. Earl C. Elkins, 200 First Street S. W., Rochester, Minnesota, for application.

Hypnosis, An Adjunct in the Treatment of Neuromuscular Disease

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● Many diseases seen by the physiatrist can be greatly helped with the use of hypnosis. Certain distressing symptoms of neuromuscular disease can be alleviated substantially. Pain as seen in the whole disease realm can be obtunded or eliminated. Spasticity can be reduced in multiple sclerosis, syringomyelia, traumatic myelitis, etc., where partial function remains. Incontinence is readily controlled in spinal cord disease for long periods. The female paraplegic can learn bladder and bowel control and the male can learn the latter. Incoordination in the mild athetoid can be minimized greatly by conditioned relaxation which can be learned immediately in the trance state. This effect is of long duration. Phantom limb syndrome is easily treated with hypnotic suggestion and the time element in re-education of muscle function and prosthetic use can be reduced significantly. Protein and fluid intake in the debilitated patient can be increased to desired levels, increasing the healing rate of the too often seen decubitus ulcer and decreasing convalescent time. Hypnosis is no panacea but is a valuable adjunct to treatment of neuromuscular disease. It is not applicable to all patients and is a technic which may prove inefficient for some clinicians.

The physiatrist daily sees patients who can be helped by the application of certain phenomena produced in an hypnotic trance state. It is not within the scope of this paper either to discuss the development of this state or to elaborate on the subject of hypnosis. Suffice it to say that over half of the patients who could benefit from hypnotherapy are able to achieve a sufficient state of trance to benefit from hypnotic suggestions. Conditions that can be helped and the probable mechanism which is responsible for this will be discussed.

The symptom of pain as associated with arachnoiditis, dermatomyositis, arthritis, burns, paraplegia, neoplasms, etc. can be alleviated or completely eliminated by posthypnotic suggestion for periods varying from several hours to weeks. For instance, the patient in a trance state is relaxed and experiences little or no pain while tightened muscles and supporting structures are being stretched in treating poliomyelitis or frozen shoulder. With appropriate verbalization the patient has no post-treatment discomfort or fear of future treatment sessions.

Mechanisms of pain control are not clear, but it is surmised that afferent impulses are blocked at the thalamic level, preventing spread to the cortex.

In order to facilitate hypnotherapy and to prolong the effect of suggestion, recordings can be made of the treatment session which will periodically reinforce the suggestions that are presented when played at home. Office dictation equipment is available which cuts recordings that play at 33⅓ r.p.m. on any good record player.

Incontinence and spasticity can be controlled or reduced in spinal cord disease as seen in multiple sclerosis, syringomyelia and in incomplete cord lesions associated with trauma. Urinary incontinence associated with syringomyelia and multiple sclerosis, can be controlled in both males and females, although there appears to be a sex variation in partial paraplegia. Females can be taught bladder control, but all efforts by the author to teach males have failed. The reason for this will be discussed below.

In the patient with a partially injured or diseased cord, spasticity can be controlled well by posthypnotic suggestion, providing the patient is a very good subject. This control, it is believed, is in the midbrain, suppressing afferent impulses and more active inhibition of existing lower motor neuron activity.

The author feels that bladder control in both syringomyelia and multiple sclerosis is achieved by damping the afferent flow of impulses from the bladder and modifying the efferent flow which ordinarily produces involuntary contraction of the bladder resulting in incontinence. In both these diseases the patient is asked while in the trance to remember urinating at a time previous to the onset of the symptoms. Posthypnotic sugges-

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tions are then given that continence will be maintained. Double vision in multiple sclerosis can also be controlled, apparently by the same mechanism.

In the paraplegic of the fourth or lower lumbar segments, bowel control is quite readily taught using the duodenal-colic reflex. Although the voluntary centers of defecation are impaired, some autonomic function remains and in the trance state this is available to the patient. The patient induces the trance state, abreacts the experience of defecation and elimination follows, produced apparently by the increased activity of the colon. As stated above, there is a sex difference in teaching bladder control to partial paraplegics. The external sphincter in women is poorly developed and it is not difficult to teach a good subject to develop her own trance and remember bladder contraction or relaxation. The patient can thus learn to urinate as well. Eventually this conditioning becomes so strong that merely assuming the position on the toilet stool results in bladder or bowel emptying. The author has had no success in teaching trance state bladder control to males apparently due to the well developed and controlled external sphincter which does not relax sufficiently with suggestion to permit urination.

Athetoid movements as seen in the individual with mild cerebral palsy can be greatly minimized or eliminated altogether, and this results in improvement in speech and all voluntary functions. Each is taught how to develop the trance state in order to use the auto-suggestion of relaxation, which helps him to perform at the height of his capabilities, particularly when confronted with a tension situation. Cues are used to reinforce these suggestions. For instance, when the patient sits down at a typewriter he is taught to take three deep breaths. Relaxed, his fingers perform much better. These patients find that after a period of conditioning they no longer have to put effort into a conscious relaxation. To explain this effect one must assume that aberrant activity of the extrapyramidal system is dampened in some manner.

One of the most successful uses of hypnotherapy is in the treatment of the phantom limb as reported often in the literature. Just as dental patients after hypnotic suggestion can learn immediately to accustom themselves to the new dentures, the amputee can also have immediate acceptance of his prosthesis. It is well known that habit patterns can be quickly learned and altered with hypnotic suggestion. Movement patterns with the new prosthesis also can become a habit pattern in short order.

Malnutrition secondary to burns and other debilitating diseases can be reversed by giving the hypnotized patient suggestions that he is very hungry. Fluid intake can be increased to the required level in the cord injured patient, decreasing his chances of developing renal complications.

The physician interested in using this modality must realize that, as with all other procedures in medicine, results are variable depending on the skill and judgment of the individual practitioner. Learning the technic of hypnosis may be time consuming and its use may prove cumbersome. After considerable experience, however, one finds that time considerations become less of a problem due to better selection of subjects and utilization of various short cuts.

The problem is entirely one of semantics, imagination and knowledge of physiology. As communication improves by daily application of the technic, time and effort decrease and more favorable results are achieved.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Adaptation to Marie-Strumpell Arthritis

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● This study covers extensive research during the period 1926-1959 relative to adjustments of Marie-Strumpell arthritis patients discharged from the hospital. Geographic locations, accuracy of diagnosis, military and vocational histories, emotional, marital and work conditions have been considered. Factors responsible for motivation, or lack of motivation, have been worked out in detail from a medical, social and vocational point of view. Reasons for failures in adaptation to chronic diseases are clearly uncovered, and this points out possible reasons for our failure to rehabilitate fully many of our patients even though physical improvement has been very successful.

This is a study of the adaptation made by patients to Marie-Strumpell's arthritis. It discusses how satisfactory this adaptation is to the patient's family and to himself; the influence of the kind of person he was before his illness; and the type of diagnostic, therapeutic and rehabilitative treatment he received. This disease may become so disabling as to require major life readjustment on the part of both patient and family, making its consequences more significant than its low incidence would suggest.

Marie-Strumpell arthritis (ankylosing spondylitis) was described by Marie (1898), Strumpell (1897) and VonBeckterew (1899). The disease, much more common in males than in females, is characterized by an early adult onset with persistent, though at times relenting, progression. Typically, there is loss of weight and strength, muscle atrophy and a marked tendency to flexion deformity of the spine. Pain and stiffness of the joints, its predominant features, are worse in the morning, or after periods of immobility. Extensive ankylosis leads to fixation of the spine and its adjacent structures. The end result is the pathetic picture of a thin, chronically ill, discouraged man, standing stooped with his head hanging forward and with flexed hips, knees and arms.

Method of Study

Fifty-six male patients treated in this hospital between 1926 and 1959 provided the study group. The clinical records were carefully reviewed to confirm the diagnosis. Not included in the study were cases in which the history, physical and x-ray findings were considered to be inadequate to corroborate diagnosis. Some cases were rejected in which other illnesses appeared to contribute a major share of the patient's disability. Cooperation of social service departments of Veterans Administration hospitals and regional offices were enlisted to insure a personal follow-up interview with every patient, or with a close relative. In most cases, claim files, old social service records and vocational rehabilitation files were available for review. Geographic coverage of the series is largely the Pacific Northwest, giving climatologic conditions of high rainfall in the western part of the area, and hot, dry summers in the eastern portion.

Patient Sample

Our sample is all male, and includes diagnoses made between 1926 and 1959 at this hospital (table 1). Of these 56 patients, 13 were veterans of World War I, five peacetime but service-connected; 41 were veterans of World War II, and two were Korean War veterans. A breakdown among the services represented were: Army 37, Navy 17, Marines and Coast Guard three. Twenty-nine were privates (or equivalent) and 27 were non-commissioned officers. Length of service varied from 90 days to over five years. (Some served in more than one war and in more than one branch of service.) Seven were discharged in less than a year and three within 90 days because of arthritis.

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This paper was reviewed in the Veterans Administration and was approved by the Chief Medical Director. The statements and conclusions are the result of the authors' own studies and do not necessarily reflect the opinion or policy of the Veterans Administration.

Table 1: Factors Contributing to Post-Diagnosis Adjustment

Status at Diagnosis	20 Patients Resigned to Inactive Dependency Role	36 Patients Struggling to Accommodate
Age:		
Under 25 years	1	8
25 to 35 years	7	22
Over 35 years	12	6
Education:		
Grade school only	9	8
Some high school	5	15
Some college	0	6
Unknown	6	7
Compensation: Service-connected		
Marie-Strumpell arthritis	7	15
Service-connected, other conditions	2	3
Non-service connected pension	10	2
None	1	16
Branch of Service:		
Army	14	22
Navy	6	11
Coast Guard and Marines	0	3
Rank in Service:		
Private or equivalent	14	15
Non-commissioned officer	6	21
Length of Service:		
Less than 90 days	0	5
90 days to 1 year	5	3
1 year to 2 years	9	12
2 years, and over	6	16
Years of Diagnosis:		
1920's	2	0
1930's	1	3
1940's	12	22
1950's	4	11
Employment Before Diagnosis:		
None (or service only)	4	7
Unsteady	4	5
Steady, but incompatible with M-S disease	10	13
Steady, but compatible with M-S disease	2	11
Living Arrangements:		
Alone	7	2
With spouse	8	31
With other relatives	5	3

Employment prior to diagnosis. Included are many forms of common labor as well as semi-skilled and skilled occupations. Twelve had been doing common labor in the lumbering industry or in the railroads, six were students attending college under veterans' benefits. Others were mechanics, truck drivers, clerical workers, postal and grocery clerks, fishermen, mine workers, taxi drivers, farmers, salesmen, longshoremen, displaymen, firemen, line-men, steamfitters, tile setters, and a coast guardsman.

Marital status. Thirty-four were married and living with their spouses. More than half had children. The remaining third were unmarried, living with relatives, or alone.

Follow-up Findings

Characteristics of the post-hospitalization adjustment of these patients were studied by a systematic collection of their hospital records and a current social service interview with the patient, or a member of his immediate family. Data were compiled on age, marital status and living arrangements; post-diagnosis education or rehabilitation training; occupation and employment status; compensation status; care requirements and

adjustment attitudes. The patients could be separated reliably into a group of 20 who rather early after diagnosis had become resigned to a disability-dependency status and made little or no effort to rearrange their lives, so as to function usefully, despite disability. Another 36 exhibited a pattern of determined struggle to achieve as normal a life as possible within the inevitable limitations of the disease. This group we call "accommodators." There were two who made good starts as "accommodators," but who now (1959) would have to be called "resigners."

Typical of resigners, Mr. M., an aviation chief machinist mate, was 45 years old before diagnosis of Marie-Strumpell arthritis was made in 1930. From 1935 on he was considered permanently and totally disabled, primarily because of arteriosclerotic heart disease. He lived in his own home with his wife (they had no children), finding his veteran's compensation adequate for a comfortable living. He made no effort to obtain education or training for employment and appeared to be well satisfied with his mode of living. He died in a VA hospital in 1956. At autopsy, the cause of death was given as: (1) glomerular nephritis, chronic; (2) hemorrhage from stomach ulcer, secondary to uremia; and (3) arteriosclerotic heart disease.

Most others indicated that they were too old, or too disabled to consider retraining. One was characterized by his local doctor as "resolved to a sedentary position in life." Of another, the medical-social worker who interviewed him wrote:

> "While this veteran's adjustment, both socially and industrially, leaves much to be desired, it is perhaps all that can be hoped for. With or without the disability he seems to be the type of person who would not demand too much of life . . . (he) has had this progressive crippling condition for over 10 years and during that time has developed a system of defenses that serves him well."

In the "accommodator" group were nine World War II veterans who took advantage of training or advanced education through the Veterans Administration. Fifteen made their own arrangements for additional training. One of these, a peacetime veteran, was described by the medical-social worker who interviewed him thus:

> "Mr. G. first noticed his disability about 1945 when he began to find it difficult to bend over, or to put on a coat or jacket. By 1946 he was walking around like an old man and had discovered that heat treatments seemed to make him feel better. By 1948 he had lost his appetite, was cross, irritable, and could no longer go to dances, and was in constant pain, and there was a marked curving of the spine. After returning from the hospital he attempted to work at his old job in the smelter but was sick a great deal and finally the company asked that he resign. He did not want to give up and persuaded the company to allow him to go to school where he learned to be a timekeeper, which was something he could do. They permitted this and his rehabilitation was paid for out of State funds. He is now employed as a timekeeper at the smelter."

Work status at followup. At the time of interview 28 of the 36 "accommodators" were working, one was dead, two were rehospitalized, and one was temporarily employed. One was attending school, and three had retired. Those employed had been able to continue such diverse occupations as bank teller, taxi driver, truck driver, steamfitter, salesman, lumber grader and garage mechanic. None of the jobs required heavy lifting. Only two were actually "white collar" jobs, while the others required exposure to the weather and to machinery, and involved considerable activity and change of position. Only one had moved from the Northwest for a change of climate. Half of the men changed jobs rather frequently, but remained in the same type of work; the remainder were steadily employed at the same job from two to 25 years from diagnosis. Working conditions which permitted or required the employee to move about or to change position from standing to sitting seemed to be well suited to them. Most of them stated they had modified their after-work activity. They had ceased such active sports as dancing, swimming and tennis, and had taken up golf, photography or gardening for recreation.

Post-diagnosis marital status. We had wondered if we might not find that these patients had had marital difficulties be-

Table 2: Use of Adjustment Factors

Status of Followup	20 Patients Resigned to Inactive Dependency Role	36 Patients Struggling to Accommodate
Additional Education		
Through VA	1	9
Through other agencies	0	4
None	19	23
Change in Occupation		
To unemployable status	15	5*
To more compatible employment	2	17
No change	3	14
Change in Living Arrangements		
To living alone	1	1
To living with spouse	1	2
To living with parents	0	1
To hospital or domiciliary	5	2
No change	13	30
Change in Compensation or Pension		
Same benefits as at diagnosis	12	4
Increased benefits	8	15
Decreased benefits	0	1
No benefits	0	16
Increased Care Requirements		
Prolonged hospitalization	5	2
Nursing care, own home	0	1
Domiciliary	2	0
None	13	33
Years Since Diagnosis		
0 to 4	4	9
5 to 9	5	18
10 to 14	5	5
15 to 19	2	1
20 to 24	2	2
25 and over	2	1

*Two at ages 65 and 52

cause of their prolonged disability. On the contrary, we found only one divorce directly traceable to the patient's illness. The wives who were interviewed showed an appreciation and understanding of the diagnosis. They had followed carefully medical recommendations made for the patient, such as diet instruction, and had helped them maintain good morale. Several of the patients reported that they were frequently irritable due to pain and did not know how their wives "stood it." The wives of the younger men, particularly, felt that their husbands tried to do too much working around the garden and at construction around the home in addition to full-time jobs. One wife said of her husband, "He is likely to do things he knows will lay him up the next day, just to prove he is as good as anyone else."

Post-diagnosis care requirements. The study revealed much less in the way of increased care requirements for this progressive, disabling disease than had been anticipated. Forty-seven of the 56 had remained in their own homes, or with relatives; four were rehospitalized at the time of their interview; five were in a domiciliary; one had been in his own home, but required nursing care prior to death.

The salient findings of the follow-up care are tabulated in tables 1 and 2. Table 1 summarizes the principal features of the post-diagnosis adjustment of the 56 patients subdivided into resigners and accommodators. It can be seen from this table that the accommodators made use of training and education to aid in adjustment to the disease, while on the whole, the resigners did not. In the matter of employment, the resigners became unemployable, or marginally employed, while the accommodators either continued in previous employment or changed to a more compatible occupation. There was little change in living arrangements in either group, or in

requirement for increased care. Table 2 summarizes the pre-diagnosis characteristics of the two groups to find out whether any of these characteristics stand out as possible predictors of what pattern of adaptation the patient is likely to pursue. Marie-Strumpell arthritis typically runs a long, insidious course through several distinct stages before the final crippling ankylosis of the joints becomes complete. The opportunity for therapeutic alleviation of eventual disability is present when the disease is recognized early and preventive measures instituted. The patient's ability to respond with constructive efforts to the challenge of the future crippling may also be better while he is still in the early stages, experiencing only mild symptoms. But the problem, then, is to help him look into the future as it will be if he does not accommodate.

In the last 39 years covered by this study, there have been appreciable changes in methods of therapy and in opportunities available to veterans for rehabilitative measures. About two-thirds in both groups were diagnosed in the 1940's, so we cannot attribute the difference in their adjustment patterns to therapeutic facilities in use at the time of diagnosis. Age at diagnosis would be expected to show correlation with stage of the disease, and does seem to follow such a pattern. The resigners are, in general, older than the accommodators at the time of diagnosis. Two-thirds of the resigners were not diagnosed until after age 35, while only six of the accommodators were diagnosed after 35. Thus, diagnosis at an early age appears to increase the likelihood of favorable accommodation to the disease. Education prior to diagnosis could be a measure of the degree of freedom available to the patient for making needed adjustments. Here our information is not complete, but shows slightly more education, on the average, in the accommodator group.

Classification by occupation before diagnosis also fails to show striking differences in the groups, although from the detailed social histories, one gains the impression that the accommodator group includes a somewhat higher proportion of steady workers. Compensation status before diagnosis is markedly different in the two groups. The resigners, all but one, had compensation or pension, while only half the accommodators were receiving compensation at the time of diagnosis, and these were service-connected, having been diagnosed in service. Branch of service and length of service do not show any appreciable difference, though it is worth noting that in both groups about one-third were discharged from service after rather brief periods. Rank in service shows a higher proportion of non-commissioned officers in the accommodators. This may be due to increased ability, reliability, and emotional stability, coupled with a slight educational advantage in this group. Marital status shows decided contrast. Nine of the resigners had never married, five of them were living alone. Thirty-one of the accommodators were married and living with their wives; of the five single accommodators, three were living with relatives. Thus, a significantly lower proportion of the resigners were making the social adjustment involved in marriage or family living. Treatment recommendations appear to show a slight difference. Recommendations for the resigners were largely work limitation; for the accommodators, for preventive measures such as prostheses, braces, diet.

Discussion

We may best sum up our findings with a review of the attitudes expressed by the patients. At onset, or at least at the time the patient became aware of the nature of the disease, there was extreme discouragement and a feeling that he was "done for." This is a period of severe pain. Treatment by x-ray, as one patient said, "Made everything that hurt before hurt worse." The recommendations imposed on the patient at this time are annoying: the breathing exercises are an effort; wearing the brace is uncomfortable; dieting to reduce is unpleasant. As the disease stabilizes, there is less pain and one type of patient may begin to see the good results of treatment. He is probably under 35 years of age, married, with a high school education or better, has a fairly good continuous work record,

advanced in rank in service. He voluntarily continues exercises, dieting, and wearing his brace. He begins to feel encouraged, regains his old drive and ambition and strives to remain active. As seems to be true with most of these patients, he will over-do on days he feels good, only to be too stiff to move with ease the next day. Gradually he learns to accommodate to these circumstances, taking care not to over-do, but keeping active within recognized limits. With another type, the disease is well advanced when diagnosis is made and there is little hope of improvement. Patients in this stage tend to think hospital treatment has done them no good. They may seek other forms of therapy. One of our group went to an osteopath, one to a chiropractor, and one tried "bee-sting" treatment. Several found private doctors who started them on cortisone from which they obtained temporary relief and then became worse. Regardless of the treatment, ankylosis takes place to a certain extent and pain is lessened. With some pain remaining and increasing stiffness, this type of patient begins to resign himself to these circumstances and ceases to fight the disease.

We might compare learning this diagnosis of oneself with hearing of the death of a friend on whom one has depended. Something in life is gone and it is healthy and necessary to go through "grief work" to adjust to the loss. Once this is done, it is possible to reconsider and reorganize the life pattern and make essential changes to go on living. If the diagnosis comes early enough, and the individual is healthy enough to do this, the results may be good. If the diagnosis comes late, and the individual has not made normal adjustments to his life pattern, finding it too difficult to do so, resignation is the way out.

We believe that our findings lead to these simple conclusions: (1) early diagnosis is important; (2) followup — not only medically but with social service, vocational rehabilitation and other adjunct services — through to the period of stabilization of the disease will insure the best chance of helping the patient to understand his potentialities and to make use of the opportunities available to him. Then, although he has a chronic disease, he does not permit himself to become a chronic invalid.

Acknowledgment: The authors are grateful to the Social Work Services of the Veterans Administration offices in Portland, Ore.; Seattle, Wash.; Boise, Idaho and Ft. Harrison, Mont.; of the Veterans Administration Hospitals in Roseburg, Ore., and Vancouver, Wash.; and of the Veterans Administration Domiciliary, White City, Ore.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Announcement

ANNUAL WORKSHOP

Conference of Rehabilitation Centers and Facilities, Inc.

DECEMBER 2-6, 1960

CLAREMONT HOTEL • BERKELEY, CALIFORNIA

editorial

Continuation Education in Physiatric Medicine

It is universally conceded that continuing development of physiatric medicine depends on education of high quality at all professional levels. Programs are in process of development throughout the country at the undergraduate medical student level as well as at the graduate or residency level. These, for obvious reasons, while primarily geared to long range recruitment of medical personnel, are important and should be strengthened. A much neglected but highly important area also is the post-graduate or continuation education level for active physicians in general practice. Many of these physicians graduated from medical school before teaching in contemporary rehabilitation philosophy and technics was established.

To bring the potentialities inherent in modern physiatric practice to the attention of these physicians, the American Academy of Physical Medicine and Rehabilitation under a one year grant from the American Rehabilitation Foundation of the Sister Elizabeth Kenny Foundation, this past year organized a series of Teaching Institutes. It was decided that such Institutes should 1) be primarily of a teaching nature of a high degree of excellence, 2) be co-sponsored by a Medical School as well as the American Academy of General Practice to allow for general practice credit, and 3) be held in geographically dispersed areas where there existed a need for the stimulation which usually results from the presence of nationally known and expert teachers. Four such Institutes were held last year 1) Minneapolis, Minnesota (in conjunction with the 1959 annual meeting of the American Academy and American Congress of Physical Medicine and Rehabilitation), 2) Houston, Texas, 3) Gainesville, Florida, and 4) Brooklyn, New York. Total attendance was approximately 400. Among the material covered were: surgical considerations, rehabilitation of the hand, orthotic devices in the care of lower motor neuron damage, psychiatric considerations of hand disability, neurophysiology of speech and language, clinical problems in speech and language, clinical problems in diseases of the connective tissues, survey of recent research activities in the rheumatic diseases, electrodiagnosis, and electromyography, therapeutic exercise, physical disabilities in back, neck and shoulder disease, rehabilitation of amputees, ethics and physician relationships, evaluation and management of hemiplegia, management of the herniated lumbar intervertebral disc, rehabilitation in arthritis, use and abuse of physical agents, and rehabilitation of the industrially injured workman.

The general concensus indicates that these programs were worthwhile and resulted in important primary and secondary gains. In addition, it demonstrates positive leadership on the part of the American Academy of Physical Medicine and Rehabilitation in the important area of education in the specialty. Consideration should be given to continuing this series, possible support coming from payment of tuition fees (precedents for this exist in other medical and surgical disciplines), sponsorship by pharmaceutical companies or by means of grants from other voluntary Foundations or governmental agencies such as the Office of Vocational Rehabilitation.

— Joseph G. Benton, M.D.

RESOLUTION ADOPTED

At the recent meeting of the American Congress of Physical Medicine and Rehabilitation held in Washington, D. C., the following Resolution presented by Doctor Jerome S. Tobis was adopted unanimously:

"WHEREAS the American Registry of Physical Therapists, sponsored by the American Congress of Physical Medicine and Rehabilitation but functioning as an autonomous organization has rendered an outstanding service for the past twenty years to the American people, the hospitals and medical profession of America in evaluating and certifying the qualifications and competency of more than ten thousand physical therapists and,

"WHEREAS the Board of the American Registry of Physical Therapists and its staff have given unlimited time above and beyond the call of duty in carrying out on a high level this excellent service,

"NOW THEREFORE be it resolved that this Congress in annual session assembled does hereby express its admiration and appreciation for this highly necessary and excellent work so well done over these many years and expresses the hope that the American Registry of Physical Therapists will continue this vital service and,

"BE IT FURTHER RESOLVED that this Congress particularly commend those therapists and physiatrists who have served on the Board of Registry and particularly do we wish to single out for special commendation Dr. Earl C. Elkins, Chairman of the Board of the Registry and Dorothea C. Augustin, Registrar."

May We Present . . .

RAY PIASKOSKI, M.D.

. . . the President of the American Academy of Physical Medicine and Rehabilitation for 1960-61, Doctor Ray Piaskoski of Milwaukee.

Dr. Piaskoski assumed his presidential duties at the recent Academy assembly held in conjunction with the 3rd International Congress of Physical Medicine in Washington, D. C. Dr. Piaskoski is a charter member of the Academy and has been active in the association since its inception in 1939. He was president-elect during the preceding year and prior to this office served on the Academy Board of Governors. Dr. Piaskoski was welcomed to office by the retiring president, Dr. Clarence W. Dail of Los Angeles.

Dr. Piaskoski was born on May 9, 1909 in Milwaukee. He received the degree of Doctor of Medicine in 1933 from Marquette University School of Medicine in Milwaukee. He is at the present time Professor and Chairman of the Department of Physical Medicine and Rehabilitation at Marquette University. His professional affiliations include service as Consultant in Physical Medicine and Rehabilitation, VA Hospital, Milwaukee County and St. Luke's Hospitals; Director, School of Physical Therapy, Marquette University; Director, Department of Physical Medicine and Rehabilitation, St. Joseph, Deaconess and St. Francis Hospitals; and Lecturer at Marquette University School of Nursing, St. Mary's School of Nursing, Misericordia School of Nursing, and Milwaukee Downer School of Occupational Therapy.

In addition to his busy professional life, Dr. Piaskoski has been actively interested in the Wisconsin State Rehabilitation Committee; Rehabilitation Committee of the Milwaukee County Medical Society; Medical Directors of Physical Therapy Schools; Marquette Medical Alumni Association, Governor's Conference on Aging; Community Welfare Council — Executive Committee Health Division; Hire the Handicapped, Mayor's Committee; Curative Workshop; Central Agency for Chronically Ill; Arthritis and Rheumatism Foundation; Cerebral Palsy Clinic; United Cerebral Palsy; Muscular Dystrophy Association; Multiple Sclerosis Society; Goodwill Industries; Visiting Nurse Association; and, Association for Physical and Mental Rehabilitation.

A past president of the Chicago Society of Physical Medicine and Rehabilitation, Doctor Piaskoski is currently serving as a member of the Board of Governors. He is an active member of the American Congress of Physical Medicine and Rehabilitation as well as the American Medical Association. He became a Diplomate of the American Board of Physical Medicine and Rehabilitation in 1947.

DONALD A COVALT, M.D.

. . . the President of the American Congress of Physical Medicine and Rehabilitation for 1960-61, Doctor Donald A Covalt of New York City.

Dr. Covalt assumed his presidential duties at the recent Congress meeting held in conjunction with the 3rd International Congress of Physical Medicine in Washington,

D. C. He was president-elect during the preceding year. Dr. Covalt was welcomed to office by the retiring president, Dr. Frederic J. Kottke of Minneapolis.

Doctor Covalt was born on November 11, 1906 in Muncie, Indiana. He is currently a resident of New York City. He studied at DePauw University in Greencastle, Indiana and received an M.D. degree in 1933 from Indiana University, Indianapolis. He served his internship at Cleveland City Hospital, Cleveland. He was licensed to practice medicine in the state of Indiana in 1934 and in New York in 1948.

He served in the U.S.A.F. as a Lt. Colonel from 1942 to 1946. In 1947 Dr. Covalt was appointed Professor of the Department of Physical Medicine and Rehabilitation at New York University College of Medicine where he taught both undergraduate and postgraduate classes. He also frequently lectured throughout the country.

Other appointments competently fulfilled by Doctor Covalt are Visiting Physician in Physical Medicine and Rehabilitation at Bellevue Medical Center, University Hospital, New York City; Associate Director, NYU Bellevue Medical Center, Institute of Physical Medicine and Rehabilitation; Associate Professor, NYU National Consultant in Physical Medicine and Rehabilitation; Veterans Administration, Department of Health, Education and Welfare and Office of Vocational Rehabilitation; Attending Staff Physician, Goldwater Memorial Hospital and Doctors Hospital; Consultant in Preventive Medicine and Rehabilitation, Hunterdon Medical Center, Flemington, N. J.; and Rehabilitation Center, Inc., Louisville.

Dr. Covalt has been an active member of the American Congress of Physical Medicine and Rehabilitation since 1946.

He was certified as a Diplomate of the American Board of Physical Medicine and Rehabilitation in 1947.

He was admitted to Fellowship in the American Academy of Physical Medicine and Rehabilitation on September 19, 1946.

Doctor Covalt's membership affiliations in professional and scientific organizations include the American Medical Association; American Academy of Compensation Medicine; County and State Medical Society of New York; Board of Medical Examiners; New York State Department of Education; New York Academy of Medicine; and President's Committee on Employment of Physically Handicapped.

Throughout his career, Doctor Covalt has authored and/or co-authored numerous scientific articles for publication in various medical and scientific journals.

. . . After serving in the capacity of Executive Director of the organization for almost twenty years, Doctor Walter J. Zeiter of Cleveland has resigned. He has given unstintingly of his time and advice. Doctor Glenn Gullickson, Jr., of Minneapolis, who has been serving as Assistant, has assumed this position.

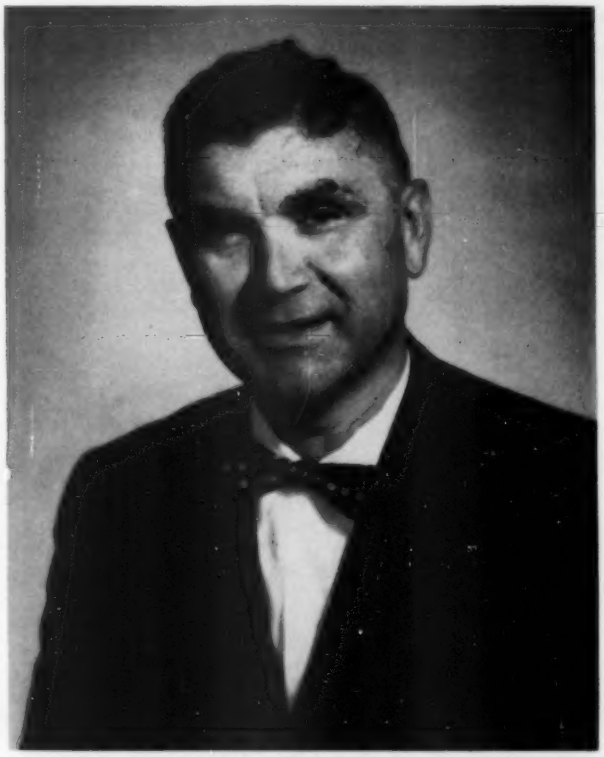
Doctor Gullickson was born on July 9, 1919 in Minneapolis. In 1945, he was graduated from the University of Minnesota Medical School. He received his license to practice medicine in Minnesota in 1949 and in California in 1954.

He was admitted to Fellowship in the American Academy of Physical Medicine and Rehabilitation in September, 1954, having been certified as a Diplomate of the American

Board of Physical Medicine and Rehabilitation in 1952. He has been a Congress member since May 1, 1952.

Doctor Gullickson is currently Assistant Director of the Rehabilitation Center at the University of Minnesota Medical School.

Doctor Zeiter has agreed to serve in the capacity of Assistant for a year or two.



JOSEPH G. BENTON, M.D.

. . . the Secretary of the American Congress of Physical Medicine and Rehabilitation, Doctor Joseph G. Benton of Brooklyn.

Dr. Benton, who is an active member of the Congress since June, 1952, was elected to this office at the recent meeting of the Congress in Washington, D. C. He is succeeding Doctor Frances Baker of San Mateo, California who after many long years of devoted service has tendered her resignation.

Now serving as Professor and Chairman of the Department of Rehabilitation Medicine at the Downstate Medical Center College of Medicine of New York State University, Doctor Benton holds his degree in medicine from New York University, which was conferred in 1945 and a Ph.D. degree from New York University in 1940. He taught medical courses at New York University, as well as Cornell University and Hunter College, and most of his hospital and clinical experience was obtained by appointments at Bellevue Hospital and Medical Center; Beth Israel Hospital and Hospital for Joint Diseases; Goldwater Memorial Hospital; Long Island Jewish Hospital; Kings County

Hospital Center, Brooklyn; VA Hospital; and Brooklyn State Hospital. He is Director of the Department of Physical Medicine and Rehabilitation of the Kings County Hospital Center.

Doctor Benton's contributions to scientific journals have been many. He is a Fellow of the American Academy of Physical Medicine and Rehabilitation, as well as the American College of Cardiology, American College of Physicians, and American Public Health Association. He holds membership in the American Heart Association, American Association of Anatomists, Gerontological Society, American Association of Medical Colleges, as well as many others, and is listed in American Men of Science. In 1953 he was certified as a Diplomate of the American Board of Physical Medicine and Rehabilitation.

G. KEITH STILLWELL, M.D.

The Editorial Board of the ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION is pleased to welcome its newest member, Doctor G. Keith Stillwell of Rochester, Minnesota. Doctor Stillwell replaces Doctor Donald L. Rose of Kansas City, Kansas for a period of seven years.

Doctor Stillwell, a Diplomate of the American Board of Physical Medicine and Rehabilitation since 1954, is at the present time with the Section on Physical Medicine and Rehabilitation at the Mayo Clinic. Born in 1918 in Moosejaw, Saskatchewan,

Canada, he was graduated and received his degree in medicine from Queens University in Kingston, Ontario in 1942. Postgraduate work at the University of Minnesota merited him a Ph.D. degree in Physical Medicine and Rehabilitation in 1954. Since that time he has been affiliated with the Elizabeth Kenny Institute, Sheltering Arms Hospital, Minneapolis General Hospital and St. Barnabas Hospital in Minneapolis.

An active member of the Congress since February, 1952, Doctor Stillwell is also a member of the American Medical Association, the Hennepin County Medical Society, the Minnesota State Medical Association, American Association for the Advancement of Science, National Rehabilitation Association, and the Biophysical Society. He became a Fellow of the American Academy of Physical Medicine and Rehabilitation in 1954.

Awards to Scientific Exhibitors

The Committee on Awards and Prizes presented through its Chairman, Dr. Donald J. Erickson, the following:

Gold Medal to W. T. Liberson, M.D., and H. J. Holmquest, M.E., for the exhibit "Electrophysiological Brace for Foot Drop in Hemiplegics."

Silver Medal to Alfred Ebel, M.D., for the exhibit "Anatomical Localization of Common Vascular Brain Syndromes."

Bronze Medal to Thorkild J. Engen, C.O., and Paul R. Harrington, M.D., for the exhibit "Experimental Designs in Functional Upper Extremity Orthotics."

Honorable Mention to Dr. Clive Shields of London for the exhibit "Demonstration by Blind Physiotherapist."

Honorable Mention to Harry T. Zankel, M.D., for the exhibit "Stimulation Assistive Exercises (SAE) in Hemiplegia."

A letter of commendation was presented to Lewis Dickar, M.D., for his unusual and very interesting exhibit of a stamp collection pertinent to rehabilitation. The title of this exhibit was "Philately in Rehabilitation."

LEWIS A. LEAVITT, M.D.

. . . the fifth vice-president of the American Congress of Physical Medicine and Rehabilitation, Doctor Lewis A. Leavitt of Houston.

The members of the Congress would like you to meet their newest officer and member of the Board of Governors. Dr. Leavitt was born on May 13, 1919 in Epping, N. D. He attended Loyola University of Los Angeles and received his medical degree from St. Louis University School of Medicine in 1945. His internship at the Queen of Angels Hospital in Los Angeles was followed by military service at Mountain Home, Tennessee, 1946-48, as Acting Chief of Physical Medicine and Rehabilitation. Residency in Physical Medicine and Rehabilitation at the VA Hospital in New Orleans with a fellowship at Tulane University at the same time, preceded his becoming Assistant Chief of the Physical Medicine and Rehabilitation Service of the VA Hospital in Houston. He was appointed Chief in 1952 and held this position until 1959 when he was appointed Chairman and Professor of the Department of Physical Medicine and Rehabilitation at Baylor University, the position he currently holds. In addition to this assignment, Dr. Leavitt is also serving as Consultant to Physical Medicine and Rehabilitation Service at the VA Hospital and the Texas Institute for Research and Rehabilitation in Houston, and as Director of the Department of Physical Medicine at Methodist Hospital in Houston. He is an Editorial Consultant to the American Archives of Rehabilitation Therapy.

Dr. Leavitt has made many written contributions to medical and scientific journals. His membership in medical and scientific societies includes the American Academy of Physical Medicine and Rehabilitation, the American Medical Association, American Association of Electromyography and Electrodiagnosis, American Institute of Ultrasonics in Medicine, Gerontological Society, Inc., as well as many others. He is medical advisor to the American Association of Rehabilitation Therapists, American Association for Physical and Mental Rehabilitation, the Texas Chapter of the American Physical Therapy Association and state medical advisor to the Texas Occupational Therapy Association. He became a Diplomate of the American Board of Physical Medicine and Rehabilitation in 1953.

. . . the Bernard M. Baruch Essay Award for 1960 was won by Doctor Burton J. Wolters of Grand Rapids, Michigan. His paper was entitled "Follow-up Survey Study of a Group of Elderly Above-Knee Amputees." Born in Fremont, Michigan, Dr. Wolters

BURTON J. WOLTERS, M.D.

received his medical degree from Wayne State University College of Medicine. He is currently serving a rotating internship at Butterworth Hospital, Grand Rapids, Michigan. Dr. Wolters carried out the survey study of geriatric above-knee amputees while a senior medical student at Wayne. He hopes for a career in general surgery or one of the surgical subspecialties after serving in the armed forces.

. . . Doctor Arthur L. Watkins of Boston has resigned as a member of the Registry Board. Doctor Robert L. Bennett of Warm Springs, Georgia has been appointed to fill the vacancy.

New Academy Members

At the 1960 annual meeting of the American Academy of Physical Medicine and Rehabilitation, the following individuals were admitted to membership. Each one is a *Fellow:*

Amick, Lawrence D., Lovelace Clinic, 3019 Georgia, N. E., Albuquerque, N. M.

Archibald, Kenneth D., New York Hospital, 525 E. 68th St., New York City

Austin, Elizabeth, 1200 N. State St., Los Angeles

Burk, Richard D., 254 Croswell Rd., Columbus, Ohio

Cullis, Frank, Mayo Clinic, Rochester, Minn.

Cinquegrana, Oswald D., 2554 Pawtucket Ave., East Providence, R. I.

Cummings, Victor, Montefiore Hospital, 210th and Bainbridge Ave., Bronx, N. Y.

Dudenhoefer, Paul A., VA Center, Wood, Wis.

Fidrocki, Henry E., Lemuel Shattuck Hospital, 170 Morton St., Jamaica Plain, Mass.

Garrett, Claude W., Jr., VA Hospital, 1601 Perdido St., New Orleans

Henriksen, J. D., Chief of PM&R, Battle Creek Sanitarium, Battle Creek, Mich.

Herring, John M., Georgia Warm Springs Foundation, Warm Springs, Ga.

Hines, Thomas F., 789 Howard Ave., New Haven, Conn.

Johnson, Ernest W., Dept. of PM&R, Ohio State University, Columbus, Ohio

Jones, Robcliff, 2101 Reading Rd., Fairfield, Conn.

Kenrick, Margaret M., Georgetown University Hospital, 3800 Reservoir Rd., N. W., Washington, D. C.

Lippmann, Heinz I., 1192 Park Ave., New York City

Owen, Richard R., Elizabeth Kenny Inst., 1800 Chicago Ave., Minneapolis

Pai, Lucille T., Inst. for Crippled & Disabled, 400 First Ave., New York City

Peszczynski, Mary Robb, Highland View Hospital, Harvard Rd., Cleveland

Reichel, Samuel M., 144 W. Minnehaha Pkwy., Minneapolis

Roth, Joel L., PM Serv., Brooke Army Hospital, Fort Sam Houston, Texas

Rothman, Leon M., 2453 Ocean Ave., Brooklyn

Smith, Edwin M., University Hospital, 1313 E. Ann St., Ann Arbor, Mich.

Smith, Ivan C., 275 W. Federal St., Youngstown, Ohio

Stevens, Robert G., Williamsport Hospital, Williamsport, Pa.

Vinograd, Abraham, VA Hospital, Wilmington, Del.

Young, John S., 6101 W. Colfax Ave., Denver

New Congress Members

The following individuals were officially elected to membership in the American Congress of Physical Medicine and Rehabilitation. Membership classification immediately follows each name:

Alexander, Raymond A., M.D. (*Active*), 2208 Olive St., Mt. Vernon, Ill.

Armstrong-Ressy, Carlos T., M.D. (*Active*), VA Hospital, Tomah, Wis.

Arroyo, Pedro, Jr., M.D. (*Active*), 1475 N. W. 14th Ave., Miami, Fla.

Barber, Herbert G., M.D. (*Affiliate*), 1937 Sunnyslope Rd., Milwaukee, Ore.

Barcome, Donald F., M.D. (*Affiliate*), 5726 Creekbend, Houston, Texas

Brownell, William M., M.D. (*Active*), 808 Murray Ave., Durham, N. C.

Calderon, Aureo, M.D. (*Active*), Box 86, Carolina, P. R.

Canilang, Enrique P., M.D. (*Active*), 3369 W. 30th St., Cleveland

Carrozzo, Nunzio J., M.D. (*Active*), 24 Schuyler Heights, Menands, N. Y.

Cherup, Nick, M.D. (*Active*), 24215 Hill, Warren, Mich.

Chinn, Austin B., M.D. (*Active*), 2107 Adelbert Rd., Cleveland

Cooney, Donald V., M.D. (*Active*), 44 Claydon Rd., Garden City, N. Y.

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Award of Merit for the Year 1960

The Committee on Gold Key Award presented through its chairman, Dr. Donald J. Erickson, the distinguished service key to:

DR. PHILIPPE BAUWENS

DR. PHILIPPE BAUWENS — *Physician, Educator and Humanitarian: Who has earned the respect of his associates by his wisdom, counsel, good-will and fellowship; who has rendered great service to the field of physical medicine and rehabilitation through his services as enthusiastic worker thereby making him representative of outstanding leadership in physical medicine and rehabilitation; who, by his tireless efforts and many accomplishments has notably advanced the Science and the Art of Physical Medicine and Rehabilitation.*

For the first time in history, the gold key award of the American Congress of Physical Medicine and Rehabilitation goes across the sea in recognition of the major contributions of a man known everywhere in the world where physical medicine and rehabilitation are practiced.

Dr. Bauwens was born on March 4, 1901 in Ostend, Belgium. He received his degree in medicine at St. Thomas' Hospital Medical School in London in 1924. At the present time, Dr. Bauwens is the Physician in Charge of the Physical Medicine Department at St. Thomas' Hospital. He holds similar posts at the Royal Marsden Hospital and Moorfields Eye Hospital. His professional affiliations include service as past president of the British Association of Physical Medicine; Honorary Secretary of the International Federation of Physical Medicine since its inception in 1952; and president of the Section of Physical Medicine of the Royal Society of Medicine. His interest in medical electronics has earned him a seat on the Council of the Biological Engineering Society.

His acknowledged eminence in electromyography and electrodiagnosis, as well as in research of significant proportions are among his many notable distinctions. He has reached a stature in all parts of the world attained only through long and diligent application.

Frank H. Krusen Honored at Breakfast

The Connecticut Society of Physical Medicine honored Dr. Frank Hammond Krusen at the American Treat Breakfast held in conjunction with the Third International Congress of Physical Medicine in Washington on August 23, 1960. Dr. Krusen was presented with a gold medal modeled by Mr. Gilroy Roberts and Mr. Paul Manship. Bronze copies of the medal may be purchased from PHYSICAL MEDICINE MEDALS, 360 Fountain Street, New Haven 15, Connecticut.

we meet . . .

in Cleveland . . .

in 1961 . . .

survey of selected literature

This systematic abstracting and indexing of selected journals is made possible by a grant from the American Rehabilitation Foundation, a subsidiary of the Sister Elizabeth Kenny Foundation.

ACTA ORTHOPAEDICA SCANDINAVICA. *Vol. 29 (Part 4) 1960.*

◇ **Increased Anteversion of the Femoral Neck as Sole Sign of Dysplasia Coxae. I. Alvik. pp. 301-305.**

The average, physiological angle of anteversion of the femoral neck in adults is about 12 degrees. This angle is larger before birth and in small children and it decreases in the first years of life. Increased anteversion is a factor very often present in congenital hip joint dysplasia. In this article cases of hip joint dysplasia which have increased anteversion as the only demonstrable defect in the hip joint are reviewed.

If the hip joint is in place and the anterior part of the capsule is not overstretched the hip joint is stable. The leg is then in a position of more or less inward rotation and the individual walks with his leg turned inward and the feet pointed medially. The gait is stumbling and shaky and the child falls easily. The anterior part of the foot is pressed into abduction and the increased anteversion is therefore an important cause of flat foot development. It can also provoke muscle pain in the hip muscles owing to increased static muscle exercise. Whoever succeeds in compensating the increased anteversion by means of increased outward rotation brings the caput into a subluxated position and the hip becomes instable. The symptoms are the same as in hip joint subluxation and vary with the degree of subluxation, exertion, development, etc. The diagnosis is made roentgenologically or clinically by the demonstration of increased internal rotation and limited external rotation of the hip joint. Increased internal rotation and at the same time normal or increased external rotation show that subluxation changes also exist as with the common forms of dysplasia coxae. The increased anteversion is presumed to be the cause of many of the so-called primary hip joint arthroses. The treatment is subtrochanteric rotation osteotomy.

◇ **The Weight-Carrying Function of the Human Spine. E. Asmussen. pp. 276-288.**

The common explanation of the function of the spine and its muscles today seems to be that gravity tends to increase all curves of the spine which act as a compressible spring. The muscles in front and back of the spine keep it in balance, and the relative strength of abdominal and back muscles determine the individual shape of its curves. In the present study this hypothesis has been reinvestigated by determining the position of the line of gravity in relation to the joints of the lumbar column and by electromyographic studies of the muscles in front and back of the spine in the standing position. The method for locating the line of gravity was that suggested by DuBois Reymond (1903).

On an average, the line of gravity for head, arms, and trunk was found to lie 1.3 cm. in front of the vertical through the ear-opening, but the variation was considerable. The vertical through the ear-opening runs on an average 1.05 cm. ventrally to the center of the body of the 4th lumbar vertebra. In 50 out of 200 boys, however, this line passed behind the center. In the majority of the subjects tested the muscles of the lower erectores spinae acted as antigravity muscles in standing, whereas the abdominal muscles were silent. But in three out of some 20 subjects the abdominal muscles were antigravity muscles, and the lumbar were silent.

It is concluded that in the majority the line of gravity passes in front of the spinal column, which is held mainly by the reflex contraction of the muscles of the back. In a minority (less than 25 per cent) the line of gravity passes behind the center of the fourth lumbar vertebra and the abdominal muscles are the active antigravity muscles. This minority appears to be less well developed physically than the majority.

The spine, therefore, does not in general approach the line of gravity, and gravity will not tend to increase all curves of the spine, but will rather tend to diminish the lumbar lordosis.

A biostatic investigation. The standing posture of man theoretically and statometrically illustrated. *Molhave, A. p. 292.*

Double-contrast arthrography of knee with horizontal roentgen ray beam. *Andren, L., and L. Wehlin. p. 307.*

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THE AMERICAN JOURNAL OF ROENTGENOLOGY. *Vol. 84, July 1960.*

◇ **The Significance of Abnormalities of the Cervical Spine. D. L. McRae. pp. 3-25.**

Bony abnormalities about the foramen magnum are not infrequently misdiagnosed as myelopathies not readily amenable to effective treatment; whereas if the true cause, osseous in origin, were discovered then surgical or other corrective procedures might lead to considerable improvement.

Chronic atlanto-axial dislocation may result in the odontoid process of the axis compressing the medulla or cord since the usual dislocation of the atlas is forward. Lateral cervical spine views should be made in full flexion and extension of the neck. Another condition not often recognized is the separate odontoid process of the axis, some cases of which may be congenital in nature. Its importance is that it may lead to the atlanto-axial dislocation described above. Occipitalization of the atlas may permit odontoid pressure on the medulla with serious sequelae easily mistaken for a demyelinating disease. Basilar invagination in which the margins of the foramen magnum are turned upward may not cause symptoms but the condition often presents very difficult diagnostic problems. Posterior spondyloschisis, the Klippel-Feil syndrome and the Arnold-Chiari malformations are mentioned as often asymptomatic. Cervical disc, osteoarthritis and spondylosis are discussed and the notion that a smaller than usual anteroposterior diameter of the cervical canal may account for the differences in severity of symptoms in this group of diseases is suggested.

◇ **The Value of Routine Plain Roentgenograms in the Diagnosis of Sacral Perineurial Cysts. L. A. Hadley. pp. 119-124.**

Perineurial sacral cysts whose incidence is not uncommon may go undetected or misdiagnosed. They usually occur over the dorsal surface of the posterior root of the second or third sacral nerve and later encrouch on the ventral root. Infrequently they are multiple and may involve any of the sacral or coccygeal roots. The symptoms produced can resemble any of the syndromes involving sacral or coccygeal roots and thus may simulate a whole host of other more commonly diagnosed conditions. Backache, coccygodynia, paresthesias and bladder dysfunction are some of the more common findings. Plain roentgenograms of the sacrum often show the white curvilinear line so characteristic of these cysts. Stereoscopic views are essential to distinguish the many other normally curved lines in this region. Diagnostic difficulties may still be encountered. Myelography may help in those rare cases where there is communication with the subarachnoid space. The condition, rarely asymptomatic, should be considered in low back or sciatic pain with sensory or motor deficits of sacral or coccygeal root distribution.

Radiologic aspects of chemopallidectomy and chemothalamectomy. *Arnois, D-C., and P. Taarnhoj. p. 113.*

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ARTHRITIS & RHEUMATISM. *Vol. III, June 1960.*

◇ **Clinical, Metabolic and Endocrinologic Effects of Abrupt Cessation of Maintenance Cortisone Acetate Therapy in Rheumatoid Arthritis. E. Calkins; L. L. Engel; D. M. Mitchell; P. Carter, and W. Bauer. pp. 204-217.**

Three adult male patients with rheumatoid arthritis who had been on cortisone therapy for periods exceeding two and one-half years were studied by clinical, metabolic and endocrinologic means before and after cessation of cortisone therapy.

Within 24 hours of cortisone withdrawal the patients exhibited symptoms of relative adrenal insufficiency which persisted four days. Constant, dull frontal headache, aching of muscles, anorexia, and prostration were noted and subsided after the fourth day.

In addition, the patients also experienced exacerbation of the rheumatoid arthritis as manifest by increased stiffness and soreness of joints plus some joint effusion. This persisted ten days until resumption of steroid therapy.

Metabolic studies revealed a positive sodium balance as evidenced by sodium retention and an increased plasma volume.

Cortical excretion data indicated that reduced adrenal cortical function persisted beyond the four day clinical picture of adrenal insufficiency. This is probably due both to adrenal insufficiency and to a lesser degree to pituitary insufficiency.

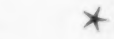
◇ **Large Cysts in Lower Leg Originating in the Knee Occurring in Patients with Rheumatoid Arthritis. J. P. Harvey, Jr., and J. Corcos. pp. 218-228.**

Large cysts in the posterior knee and lower leg may be present in some cases of rheumatoid arthritis. Four rheumatoid patients with such cysts are presented. The mechanism of formation of these cysts is unclear. It has been suggested that prolonged steroid therapy with resultant weakening of connective tissue may be an etiologic factor. Size of the cysts may vary with activity of the rheumatoid process. Surgical excision of the cysts relieves leg discomfort and removes interference with gait. However, postoperative recurrences are frequent.

Experimental hemarthrosis: The removal of chromium-51- and iron-59- labeled erythrocytes injected into the knee joint of rabbit and man. *Rodan, G. P. p. 195.*

The stiff-man syndrome: Report of a case. *Stuart, F. S.; M. Henry, and H. L. Holley. p. 229.*

Current comment: The nomenclature of mucopolysaccharides. *Jeanloz, R. W. p. 233.*



BRITISH MEDICAL JOURNAL. *Vol. 2, July 1960.*

◇ **Aortic Incompetence in Ankylosing Spondylitis. R. S. Crow. pp. 271-273.**

It has been recently recognized that patients suffering from ankylosing spondylitis may develop aortic incompetence due to a type of aortitis and aortic endocarditis that has distinctive pathological features.

The literature concerning this cardiac lesion is reviewed and the author presents a case of his own with the characteristic clinical and pathological features. The aortic lesion is in general progressive and causes increasing disability and eventually death within a few years. The most striking pathologic feature is a curious thickening of the aortic intima and endocardium, with rigidity and distortion of the aortic valve. The histological features resemble those of syphilis, but there is no history of clinical or pathological evidence of syphilis.

The relationship of the distinctive aortic lesions to ankylosing spondylitis and to rheumatoid arthritis and rheumatoid heart disease is briefly discussed. The existing evidence suggests that it should be regarded as a visceral complication of this disease.

◇ **Spontaneous Subluxation of the Sternoclavicular Joint. J. G. Bonnin. pp. 274-275.**

The author calls attention to a rare and not so rare condition which appears to be limited entirely to the female sex. This consists in a slow painless subluxation of the sternoclavicular joint. The subcutaneous bulge produced by the sternal end of the clavicle may commonly raise the suspicion of neoplastic change in the region. A brief account of 11 cases observed by the author over a two-year period is presented.

◇ **Multiple Sclerosis. H. Miler; A. Ridley, and K. Schapira. pp. 343-345.**

A survey of multiple sclerosis in Northumberland and Durham has furnished the authors with the material for assessment of the social incidence of the disease. From a population of approximately 1,400,000 patients of all ages, a total of 662 cases with definite diagnosis of multiple sclerosis were drawn.

The patients yielded by the survey comprised 390 females and 272 males. The categorization by social class was expressed in five groups. Class I, professional, etc.; class II, intermediate occupations; class III, skilled occupations; class IV, partly skilled occupations; class V, unskilled occupations. Social classification of the patients was based on their occupation at time of the onset of the disease, or on the husband's or father's occupation in the case of female patients.

The percentage of distribution by social class revealed no special sex differentiation between male and female patients. The greatest number of patients with multiple sclerosis was found in social class III, which showed a 56 per cent distribution for males and 63 per cent for females. The smallest number was represented by class I group which was five per cent and six per cent

for male and female respectively. The figures, like most relating to multiple sclerosis, are suggestive rather than conclusive.

◇ **Effects of Human Growth Hormone in Man. P. H. Henneman; A. P. Forbes; M. Moldawer; F. G. Dempsey, and E. L. Carroll. pp. 1223-1238.**

This paper summarizes balance and clinical data from 10 patients treated with daily intramuscular injection of 0.2 to 10 mg. of human growth hormone (HGH). Linear growth was stimulated in three and probably stimulated in two other of the five patients with open epiphyses. Nitrogen retention was produced in all patients. Phosphorus, sodium, potassium and calcium retention was also observed in the proportions characteristic of muscle and bone. The most consistent and sensitive indices of response to HGH were the decreases in urinary nitrogen, sodium and potassium. At the dose levels used the chemical response to HGH waned after three to four weeks continuous treatment. Responsiveness is restored by 12 days of growth hormone.

Stress incontinence of urine. *Kennedy, C. p. 263.*

Pretibial myxoedema. *Gimlette, T. M. D. p. 348.*

The toxic effects of carbon dioxide and acetazolamide in hepatic encephalopathy. *Posner, J. B., and F. Plum. p. 1246.*

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ERGONOMICS. *Vol. 3, Jan. 1960.*

◇ **Man as a Source of Mechanical Power. D. R. Wilkie. pp. 1-8.**

For a short period of time very heavy work can be performed, but total power output diminishes steeply with increasing duration of exercise. After five minutes, continued effort causes a much slower decrease of power output.

Muscular energy is available from two sources: steady oxidation and hydrolytic reactions. The former produces 0.5 h.p., which after 25 minutes falls to 0.475 h.p. The latter source produces 0.6 h.p. min. released over a long or short period depending on need.

Optimum work is achieved when the force overcome by muscle is one-half maximum and the speed of movement is one-quarter maximum value. No athletic event achieves maximum conversion efficiency, however, cycling most closely approached the ideal.

The author calculated the power output of champion athletes under different working states. Single, short duration movements are limited to 6 h.p. Brief bouts of exercise lasting one to five minutes are limited to 0.5 to 2.0 h.p. Steady-state work for five to 150 minutes is limited to 0.4 to 0.5 h.p. and all day work is limited to nearly 0.2 h.p.

Ordinary individuals can produce only 70-80 per cent of the power the champion athletes produced in this study.

◇ **The Eosinopenia of Physical Exercise. J. W. T. Redfearn. pp. 17-29.**

Selye has stated that the eosinophil count is highly sensitive to various physical and emotional stresses. By pooling diluted blood samples from a group of men a mean eosinophil count can be obtained.

The author subjected 19 young soldiers to various durations of marching, at various speeds on various grades and with various loads. He found the eosinophil count to be progressively depressed with increasing severity and increasing duration of physical exercise. In states of exhaustion the count is depressed to near zero. The data also indicates that with increasing fitness the eosinopenic effect is less pronounced for a given test.

The author concludes that the eosinophil count is probably the most practical way of assessing the "stress" of a physical exercise.

Evaluation of a submaximal test for estimating physical work capacity. *Rasch, P. J., and W. P. Pierson. p. 9.*

Human power output: The mechanics of pole vaulting. *Fletcher, J. G.; H. E. Lewis, and D. R. Wilkie. p. 30.*

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GERIATRICS. *Vol. 15, July 1960.*

◇ **Gout, the Rediscovered Disease. L. M. Lockie, and R. G. Cooper. pp. 497-502.**

The history of gout is a long one with many illustrious sufferers. Sydenham, afflicted with the

disease himself, contributed greatly to the clinical description and recognition of gout. Benjamin Franklin, who also had gout, is credited with introducing colchicine to the United States as an effective therapeutic agent in this form of arthritis. In more recent years, P. S. Hench and associates of the Mayo Clinic have presented to the medical profession further enlightening reports on this malady.

Approximately one per cent of the population at large suffers from this type of arthritis, which is recognized as a disease process with an inborn error of uric acid metabolism. These patients have hyperurecemia, and may develop urate deposits in the body tissues. The clinical picture is that of periodic attacks of sudden onset with a painful swollen joint. A therapeutic response to colchicine is also of diagnostic import.

Treatment of acute attacks is satisfactory, especially when instituted early. Effective agents include colchicine, phenylbutazone, triamcinolene, and corticotropin. A high carbohydrate, low fat diet should be instituted and alcohol intake restricted. Probenecid may be given indefinitely if patients have frequent attacks, tophi, or persistent elevation of serum uric acid. Surgical removal of large tophi may be necessary. Successful control of this disease is dependent upon the patients' rigid adherence to a prescribed regimen.

Management of urologic problems in the aged. *Hess, E.; R. B. Roth; A. F. Kaminsky, and H. J. McLaren, Jr. p. 503.*

Chair for the invalid patient. *Christianson, K. H., and M. Troncellitti. p. 509.*

A new nation and its aged. *Lubin, S. p. 512.*

The proctologic examination. *McGregor, R. A., and H. E. Bacon. p. 519.*

Symposium: Disability control.

I. **Diseases involving connective tissue.** *Monroe, R. T. p. 524.*

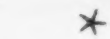
II. **Rehabilitation of the cardiac patient.** *Clark, R. J. p. 529.*

III. **Physician's fear.** *Levine, S. A. p. 534.*

IV. **The insurance industry and disability control.** *Black, S. B. p. 537.*

V. **Scope, costs, and reduction of psychiatric disability.** *Deutsch, A. p. 543.*

VI. **Summary of panel session on cardiovascular disability.** *White, P. D. p. 548.*



GERIATRICS. *Vol. 15, Aug. 1960.*

◇ **The Role of Corticoids in Osteoporosis. O. M. Martinez, and R. B. Greenblatt. pp. 555-562.**

Osteoporosis is a disease of altered bone tissue metabolism with resultant thinning, resorption, and overall loss of bone. It may be associated with a variety of endocrinopathies. Several cases of osteoporosis of varying etiology are presented.

A case of Cushing's Syndrome demonstrated X-ray evidence of remineralization of bones after removal of an adrenal tumor. One case of hypoovarianism expressed subjective improvement after replacement therapy with estrogens and androgens, although there was little objective evidence of bony remineralization on follow-up X-rays. Three post menopausal patients exhibited marked aggravation of existing osteoporosis when treated with corticosteroids.

Fundamental knowledge of etiologic factors in osteoporosis is insufficient to permit a rational therapy directed toward correction of basic causes. However, an effective plan of management can be afforded by a modification of altered factors — such as removal of the adrenal glands or tumor in Cushing's Syndrome, substitutional therapy in hypoovarianism, and androgenic therapy in anti anabolic conditions where corticoids were a factor in the osteoporoses.

Nodules of the ear and feet. *Young, A. W., Jr. p. 563.*

The occluded artery. *Simeone, F. A. p. 568.*

Reflections on group living of the aged. *Geld, S. p. 579.*

Principles in the management of arteriosclerosis obliterans. *Freund, J. p. 589.*

Clinicopathologic conference — Surgical treatment of Parkinsonism. *Goldner, M. G.; edited by B. Wainfeld. p. 595.*

Michigan conference on aging. *Hafrey, D. J. p. 601.*

INTERNATIONALE ZEITSCHRIFT FUR ANGEWANDTE PHYSIOLOGIE.

Einschliesslich Arbeitsphysiologie. Vol. 18, July 12, 1960.

◇ **The Effects of Respiratory Rate on the Mechanical Work of Breathing During Muscular Exercise. G. Milic-Emili; J. M. Petit, and R. Devoanne. pp. 330-340.**

The authors have studied the mechanical work involved in breathing at various rates during muscular exercise. Volumes were recorded by a low inertia spirometer connected to an electrical measuring system. Endoesophageal pressure was recorded by a monitoring system connected to a strain guage manometer. Subjects exercised on a bicycle ergometer at varying intensity levels, increasing their ventilation either by spontaneous changes or in time with a metronome. The authors conclude that when the tidal volume was within the range of the resting inspiratory capacity, the mechanical work of breathing was not affected appreciably by variations in respiratory rate or depth. When lung volumes below the resting end-expiratory level had to be used, the mechanical work of breathing was greatly increased, and thus mechanical work versus ventilation curves rises more steeply with lower breathing rates. When subjects were allowed to increase ventilation without any control of respiratory rate, they spontaneously chose rates and levels in the range where pulmonary ventilation involved minimal effort.

The influence of work in high environmental temperature on urinary inulin — and P.A.H.-clearance as well as electrolyte and 17-21-dihydroxy-20-ketosteroid excretion. *Starlinger, H., and R. Bandino. (Text in German.) p. 285.*

An objective method of measuring psychomotor reaction time. *Bruner, H.; D. Jovy, and K. E. Klein. (Text in German.) p. 306.*

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JOURNAL OF APPLIED PHYSIOLOGY. *Vol. 15, May 1960.*

◇ **Electromyographic Study of Local and Generalized Muscular Impairment. R. G. Eason. pp. 479-482.**

This study measures the integrated action potentials from surface electrodes during voluntary isometric contractions held to exhaustion and the residual effects of the initial exhaustive effort on a succeeding contraction.

During sustained contraction the surface electromyography activity recording both active and inactive muscle, progressively increased with time for each subject. The rate of increase was directly proportional to the magnitude of contraction for both muscle groups.

With a repeat contraction the rate of increase in electromyography activity recorded from active muscle was significantly greater than from the original contractions. The total electromyography output and total time measures were significantly smaller.

The author concludes that the gradual increase in the surface electromyography with time suggests that additional motor units are progressively recruited to compensate for the loss in contractibility due to the effects of the sustained contraction and action potentials of new units summate with units already active to more than offset the amplitude decrement of the latter.

◇ **Effect of Body Composition and Weight Gain on Performance in the Adult Dog. D. R. Young. pp. 493-495.**

The body composition and respiratory quotients were studied under a constant work load of 202.9 kg.-m./min. in eight male beagle dogs before and after weight gain due to prolonged over feeding.

The relative increase in water, fat and protein-mineral components was 42 per cent, 42 per cent and 18 per cent respectively. The latter figure suggests an increase in lean body mass as well as the expected gain in water and adipose content.

Comparing the 50 min. work performance before and after weight gains shows no change in oxygen uptake, work and recovery pulse rates. The respiratory quotient increased from .81 to .95 and water loss, during work increased from 1.16 cc./Cal. to 1.84 cc./Cal. with gain in weight and adiposity.

The increased energy expenditure and heart rate observed in overweight subjects is probably due solely to the burden of additional weight. The most important effect of weight gain is to promote increased water loss during constant steady-state work.

Mechanical work of breathing during muscular exercise. *Margaria, R.; G. Milic-Emili; J. M. Petit, and G. Cavagna. p. 354.*

Compliance of the respiratory system and its components in health and obesity. *Naimark, A., and R. M. Cherniack. p. 377.*

Carbon monoxide diffusing capacity in normal male subjects, age 20-60, during exercise. *Hanson, J. S., and B. S. Tabakin. p. 402.*

Effects of conditioning on the ballistocardiogram of college basketball players. *Montoye, H. J.; W. D. Collings, and G. C. Stauffer. p. 449.*

JOURNAL OF BONE AND JOINT SURGERY. *Vol. 42-A, July 1960.*

◇ **Luschka's Joint: A Degenerative Phenomenon. C. Orofino; M. S. Sherman, and D. Schechter. pp. 853-858.**

The presence of a joint with a synovial lining between the opposing superior and inferior margins of adjoining cervical vertebrae has been the subject of discussion since Luschka first described and illustrated joints of this type in these locations. Previous studies of this joint have been performed on adult cadavers. The author attempts to avoid the artifacts and bone hypertrophy of the adult spine by studying the cervical spines of a 13 cm. and 14 cm. fetus, eight full term fetuses and one elderly adult. Coronal and oblique longitudinal section of the cervical spine were made.

This study indicates that no synovial joint exists in the region of the uncinate processes of the cervical vertebrae. The changes seen in roentgenograms which have been ascribed to degenerative arthritis or protruded intervertebral discs are due to reactive osteogenesis. This new bone formation is a response to the repeated minor stresses of aging causing collapse of the intervertebral disc. The process is probably hastened by external trauma of varying severity.

◇ **Tonic Reflexes of the Foot. William R. Duncan. pp. 859-868.**

At birth there are four tonic reflexes of the foot which may be easily elicited by a summated stimulus such as repeated stroking or brushing. These reflex areas were outlined by the author in a study of 150 patients with cerebral palsy, 40 normal infants, and eight patients with spinal paraplegia. These reflexes are the toe grasping reflex with flexion and adduction of the toes in response to stimulation of the ball of the foot near the base of the second and third toes. The inversion reflex in response to stimulation of the medial border of the foot near the head of the first metatarsal, the eversion reflex, in response to stimulation of the lateral border of the foot over the head of the fifth metatarsal and at the base of the little toe and the dorsiflexion reflex in response to stimulation of the central portion of the plantar surface of the heel.

From studying normal infants the author found that the tonic reflexes of the foot gradually disappear during the first years of life. The disappearance is probably related to a suppressive effect of the maturing central nervous system. The reflexes do not disappear in cerebral palsied children because of damage to suppressive areas of the cerebral cortex. As a result the deforming effects of these reflexes are manifested in several ways.

If one of the reflexes is dominant and hyperactive the foot will be pulled into the characteristic position by the prime movers. These reflexes are apparently mediated through superficial sensory fibers rather than deep proprioceptive fibers as the author was able to eliminate the reflexes by procaine infiltration or ethyl-chloride spray of the reflexogenic area. The author suggests three methods of lessening the duration and intensity or elimination of the deforming reflex. 1.) Temporary interruption by blocking of the reflexogenic area with ethyl-chloride spray or infiltration with procaine; 2.) counter stimulation of a reflex which is antagonistic to the deforming reflex, and 3.) alteration of the tonic reflex by tenotomy of the prime mover. The latter method is the procedure of choice and provides prolonged and often permanent disappearance of the deforming reflex.

Experimental immobilization and remobilization of rat knee joints. *Evans, B. E.; G. W. N. Eggers; J. K. Butler, and J. Blumel. p. 737.*

Talipes equinus correction in cerebral palsy. *Martz, C. D. p. 769.*

Thirteen cases of alkaptonuria from one family tree with special reference to osteoarthrosis alkaptonuria. *Abe, Y.; N. Oshima; R. Hatanaka; T. Amako, and R. Hirohata. p. 817.*

THE JOURNAL OF CLINICAL INVESTIGATION. *Vol. 39, July 1960.*

◇ **The Effect of Changes in Posture and of Graded Exercises on Stroke Volume in Man. Y. Wang; R. J. Marshall, and J. T. Shepherd. pp. 1051-1061.**

The present investigation demonstrates the importance of the posture of the subject in the interpretation of changes in stroke volume from rest to exercise.

Four healthy untrained men, aged 25 to 35 years, were studied. Cardiac output, heart rate, and stroke volume were measured at rest in the supine position, at rest standing and during exercise in the upright position.

During rest in the supine position the average cardiac index for all subjects was 3.5 L. and the stroke index ranged from 51 to 56 ml. (average 54 ml.). The pulse rates were from 58 to 72 beats per minute. On standing there was an increase in heart rate and a decrease in cardiac output. The stroke index fell to an average value of 32 ml., a fall of 41 per cent. Mild exercise consisting of alternate contraction and relaxation of the calf muscles caused the stroke index to approach the value obtained in the supine position. Moderate exercise achieved by walking uphill at 1.7 to 2.7 m.p.h. was associated with further rise in stroke volume to values similar to those obtained with the subject in the supine position. Severe exercise, sufficient to increase the cardiac output to between 15 to 25 L. per minute was accompanied by a further slight though definite rise in stroke volume. The average stroke index at 3.5 m.p.h. was 58 ml. and at 4.5 m.p.h. 59 ml.

The present studies suggest that for a given person the stroke volume increases only slightly once exercise has begun, regardless of the severity of the exercise or the position assumed by the subject. With even the mildest exercise the stroke index increases toward the value obtained while the subject is resting in the supine position, to show only a small further increase above this value even with severe exercise.

◇ **Abnormalities of Muscle Protein Metabolism in Mice with Muscular Dystrophy. J. Kruh; J. C. Dryfus; G. Shapira, and G. D. Gey. pp. 1180-1184.**

The authors have studied the metabolism of myosin and water extractable muscle proteins in normal mice and in mice with hereditary dystrophy.

In normal mice myosin does not show any apparent turnover. The constancy of the radioactivity seems to substantiate a life span for the myofibrils of approximately 20 days. Water extractable proteins show an exponential decrease, which means that the sarcoplasmic proteins are subject to turnover.

In the dystrophic mice the radioactivity increased until the fourth day, when it was twice as high as that in the normal mice. After the sixth day it decreased and on the fifteenth day the value of the radioactivity was close to that of the normal mice. The turnover of the water extractable proteins is highly accelerated.

These results could be explained by an acceleration of the turnover of muscle proteins or by a shorter life span of the muscle cells or by both hypotheses. The first hypothesis seems more likely. It would be important to know whether or not the same abnormality occurs in human muscular dystrophy.

Metabolism of mucopolysaccharides in connective tissue. II. Synthesis of glucosamine-6-phosphate. *Bollet, A. J., and A. Shuster. p. 1114.*

Detection in normal urine of protein resembling Bence Jones protein. *Stevenson, G. T. p. 1192.*

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THE JOURNAL OF CLINICAL INVESTIGATION. *Vol. 39, Aug. 1960.*

◇ **Behavior of Stroke Volume at Rest and During Exercise in Human Beings. C. B. Chapman; J. N. Fisher, and B. J. Sproule. pp. 1208-1213.**

The authors have undertaken the present work to re-examine the question of the heart stroke volume during exercise. There has been a growing influence in recent years, especially by Rushmer, that stroke volume increases but little during exertion and rarely exceeds recumbent control values.

Studies on 26 normal men form the basis for this report. These results demonstrate quite clearly that stroke volume increases with increasing levels of exercises although the relation is probably not a linear one. The conclusion is true whether one uses standing or supine resting

conditions as a starting point. The relative importance of the mechanism appears to be greatest at the transition from rest (subject standing) to mild exercise and at levels of exercise approaching those producing maximal oxygen intake. Individual differences in response were evident and considerable. Factors determining what mechanism will be dominant, especially at low to moderate levels of exercise, are not known. Very probably, physical training, age and body composition are involved. There can be little doubt, however, that adaptation to exercise requires an intricate interdigitation of neural, myocardial and chemical factors and that ability to increase stroke volume is one of the mechanisms involved.

JOURNAL OF GERONTOLOGY. *Vol. 15, July 1960.*

◇ **The Deposition of Aging Pigment in the Human Cerebral Cortex. H. Brody. pp. 258-261.**

Accumulation of a pigmental material within the cytoplasm of nerve cells in cerebellum, autonomic ganglia, spinal ganglia and the spinal cord, has been frequently described by many authors to be related to age.

The author examined 20 brains from individuals who died of causes which would not ordinarily be expected to have affected the nerve cells of the cortex. The age range was from newborn to 95 years.

From his observation the greatest amount of pigment found in the cortex was located in the cells of the pyramidal layer (layer III). The specimens in this study were separated into four age groups: newborn to two months, 16 to 21 years, 45 to 48 years, and 70 to 95 years. Five individuals were included in each group.

A semiquantitative study was made of lipofuscin deposition in cells of the cerebral cortex of the precentral gyrus, post-central gyrus, superior temporal gyrus, and the striate cortex in order to determine its relation to age. The cells of the newborn are free of lipofuscin pigment. With progressing age there is an increase in the percentage of cells containing small amounts of pigment with a corresponding decrease in the percentage of pigment-free cells.

The effect of age on the intellectual performance of mental defectives. *Bell, A., and J. P. Zubek. p. 285.*

Changing patterns of retirement. *Gordon, M. S. p. 300.*

JOURNAL OF NEUROPHYSIOLOGY. *Vol. 23, May 1960.*

◇ **Autonomic Function of Some Small Fibers in Corticospinal Tract of Cat. K. Umar, and G. H. Wang. pp. 315-320.**

This paper is an attempt to show that the small unmyelinated fibers in the corticospinal tract have an autonomic role. The animals were anesthetized and tracheotomized. Both common carotid arteries were ligated and the central neuraxis transected with a sucker just at the rostral border of the superior border of the superior colliculi. The dorsal surface of one exposed isolated cerebral peduncle was stimulated with single or tetanic shocks from a Harvard inductorium, or a single pulse or train of pulses from a stimulator made of two generators. The ventral roots of the spinal nerves were stimulated only with single shock or pulse. In order to make sure that the effect of stimulation of the cerebral peduncle was not due to inadvertent stimulation of the descending fibers from the hypothalamus, in many experiments a second section of the brain stem was made from the lateral border of each medial longitudinal bundle at the level of the trapezoid body. Since the outflow of the preganglionic sympathetic fibers for the sweat glands in the pads of the forefoot and the hindfoot is known to be in the fourth to ninth thoracic nerves and twelfth thoracic to fourth lumbar nerves, respectively, stimulation of the ventral roots can be used to elicit the galvanic skin response. Subsequently the conduction rate of the corticospinal fibers mediating the response can be calculated according to a formula.

Since there is a lack of information on how the preganglionic sympathetic sudomotor neurons are arranged in the spinal cord, it is not possible to know the exact distance between the group of sympathetic motor neurons controlling sweating in the forepaw and that controlling sweating in the hindpaw. In any case, the order of magnitude of the conduction velocity was below 200 cm./sec. This puts the small unmyelinated axons in the C group of nerve fibers. Consequently, the authors feel justified in concluding that the function of some small unmyelinated fibers in the corticospinal tract is autonomic.

◇ **Spinal Tracts Mediating Subthalamic Hyperkinesia. Physiological Effects of Selective Partial Cordotomies upon Dyskinesia in Rhesus Monkey. M. B. Carpenter; J. W. Correll, and A. Hinman. pp. 288-304.**

This study was undertaken to determine the physiological effects of selective partial cordotomies upon choreoid dyskinesia in the Rhesus monkey, produced by lesions in the subthalamic nucleus. Differential sections of the dorsal columns, the dorsal half of the lateral funiculus, the ventral half of the lateral funiculus and the ventral funiculus were made at high cervical levels. Seventeen Rhesus monkeys were observed clinically and by means of cinematographic recording after subthalamic surgery and following the various types of cordotomy.

The hyperkinesia produced by the subthalamic lesions was abolished without later recurrence by section of the lateral corticospinal tract in the spinal cord. It was not abolished by section of the ventral half of the lateral funiculus or the ventral funiculus of the cord. It was reduced in force, amplitude and violence or temporarily abolished by lesions involving parts of the dorsal half of the lateral funiculus of the cord. Destruction of the fasciculus gracilis, fasciculus cuneatus, dorsal spinocerebellar tract, ventral spinocerebellar tract, and spinothalamic tracts did not modify significantly the hyperkinesia and probably do not play a direct role in the neural mechanism controlling this form of dyskinesia.

The impulses responsible for the dyskinesia are not transmitted to segmental levels via the rubrospinal tract, the vestibulospinal tract, or the pontine or medullary reticulospinal tracts.

The authors conclude that the impulses responsible for choreoid dyskinesia in the Rhesus monkey are mediated by the lateral corticospinal tract. They do not feel that there is any evidence that the so-called "extrapyramidal motor system" is either complete or independent. Rather, this system appears to be a functional unit dependent upon the integrity of the corticospinal system. No fibers arising from the striatum, globus pallidus, subthalamic nucleus, substantia nigra, red nucleus or thalamus appear to enter the corticospinal tract and descend except the corticoreticular fibers which descend only in part of their course with the corticospinal tract. Interaction between the so-called "extrapyramidal" and corticospinal systems probably occurs only at the cortical level.

Adaptation in regulation of movement and posture. A study of stretch responses in spastic animals. *Partridge, L. D., and G. H. Glaser. p. 257.*

Vestibular and propriospinal interactions and protracted spinal inhibition by brain stem activation. *Gernandt, B. E., and S. Gilman. p. 269.*

ANNOUNCEMENT OF A NEW PROGRAM

A new Rehabilitation Counselor Training Program has been approved by the United States Office of Vocational Rehabilitation. This program is at the University of Pittsburgh, Department of Special Education and Rehabilitation and will be offered at the M.Ed., Ed.D. and Ph.D. levels. Candidates may enter the programs in September, January and April of any year. Stipends are awarded by the United States Office of Vocational Rehabilitation. For information write Dr. L. Leon Reid, Associate Professor, Coordinator, Rehabilitation Counselor Training Program, Department of Special Education and Rehabilitation, University of Pittsburgh, Pittsburgh 13, Pennsylvania.

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